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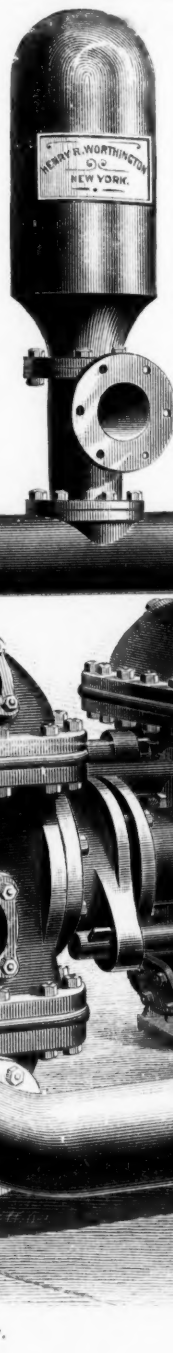
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

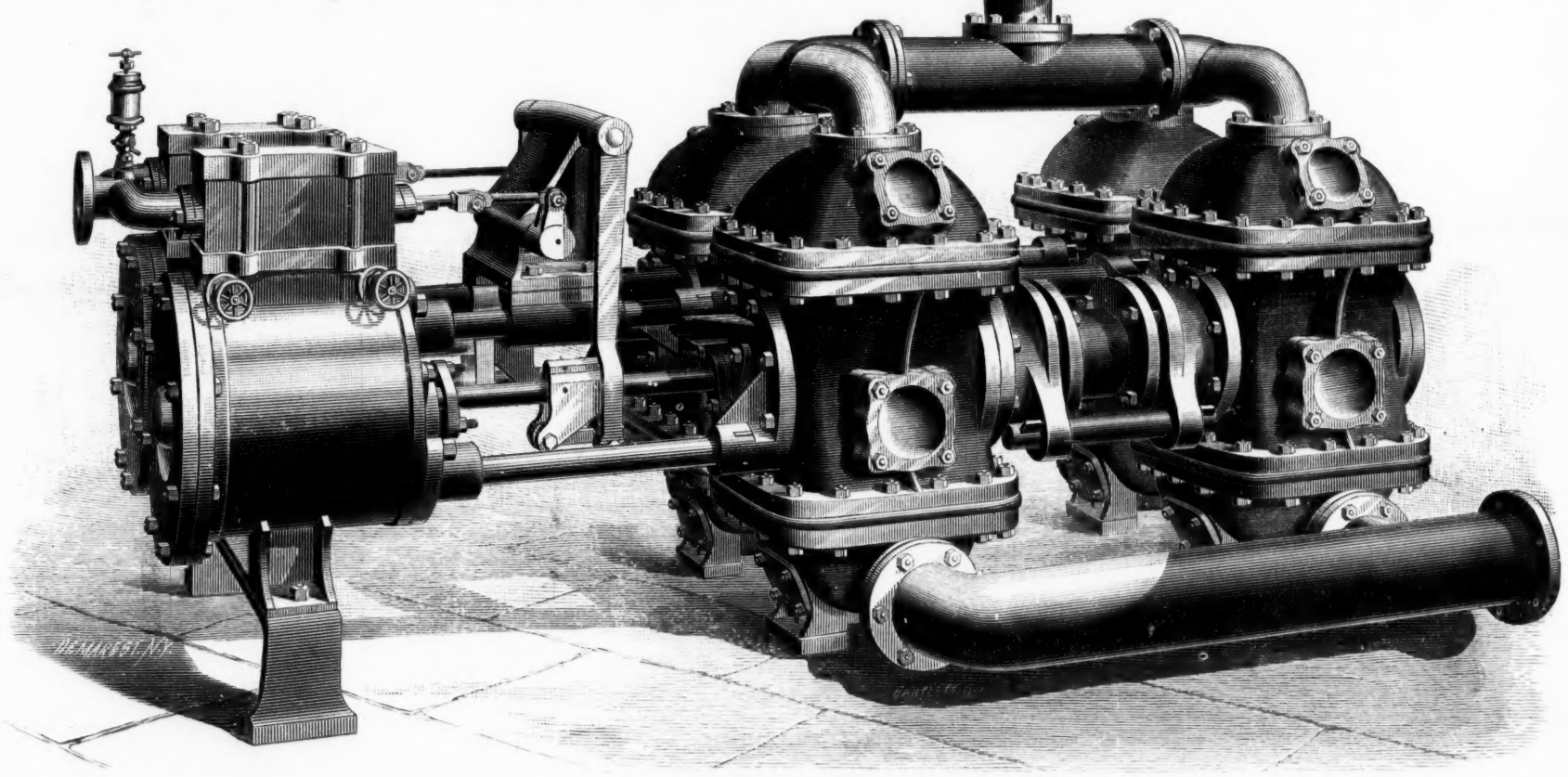
The Worthington Mine Pump.

The difficulties in the way of the successful use of steam pumps in mines are probably greater than in any other use to which they are put. Not only is the usage rough to an extent hardly appreciated in a manufacturing establishment, but the requirements are for continuous running, and the duty required of a severe character, while the facilities for repairs are of a primitive kind. Added to this the water is, in a majority of instances, impregnated with foreign substances that readily attack and rapidly destroy ordinary constructive material. These considerations involve the necessity of simple and durable construction, the selection of material best adapted to withstand the destructive action of the impurities in the water, and the providing in the construction for such a duplication of parts as shall render their quick renewal possible by unskilled labor, and without the use of tools and appliances usually found necessary.

The engraving on this page represents a new mine pump or pumping engine recently brought out at the Henry R. Worthington, Hydraulic Works, 86 and 88 Liberty street, New York, in which the requirements are well met by a construction particularly suited to the special service, and by an arrangement of parts that permits each one to be come at for renewal without disturbing others. So far as the steam end of this pump is concerned, the cylinders, valve-motion, &c., do not differ in any important particular from the well-known "Worthington" standard. The water cylinders are four in number, each entirely distinct and subdivided as much as is practicable, for convenience of repairs by renewal of small parts rather than pieces of large magnitude. Into these four cylinders the double plungers work through outside packed stuffing boxes, arranged for convenience in packing. These cylinders are not only alike so far as to insure the substitution of any of the four for either of the other three, but every piece or attachment is also interchangeable between all cylinders, without reference to their location, on pumps of the same size. This is important in ordering parts for repairs, and where several pumps of the same kind are in use, one extra pump may be kept on hand, the parts being available for repairs on any of the four cylinders for which they may be required.

The piston rods, all the valve plates, the plungers, stuffing-box liners, and such parts as are particularly subjected to the corrosive action of bad water, are made of a special metal that has proved itself well adapted to resist such action, while the water passages are made unusually large to provide as far as practicable against natural wear from rapid currents. These pumps are designed to safely withstand a working pressure of 200 lbs. per square inch, and so far as strength of parts is concerned, are especially calculated with reference to rough usage and little attention. They are made in a variety of sizes to meet the demand in this respect.





THE WORTHINGTON MINE PUMP.

Movable emery wheels are used to excellent purpose in the Rogers Locomotive Works in the finishing of guides, rods and other parts of locomotives that used to be finished by the file. When these articles come from the planer, they are laid on a bench, over which a movable emery wheel can be traversed. A workman guides this wheel over the work, and in a few minutes a rod or guide is ready for the finishing touches of emery paper.

Holding Drop Dies—Cast Steel to Pattern—Taper of Keys—Dowel Pins—Steely Iron—Soft-working Steel—Uniformity of Temper—Trusty Workmen—Skin Hardening—Returning Bad Work.

BY B. F. SPALDING.

It seems to be generally conceded that the best way to fasten dies into drops and trip-hammers for forging purposes, is with driven keys or wedges. What is the best taper for this key, is a question which has been seriously considered by the manufacturers, and some of them have decided on a taper of an eighth of an inch to a foot, while others think a better taper is a quarter of an inch to a foot. It is a fact which cannot be questioned that the less the taper the tighter the key can be driven with the same force, and the tighter the dies are keyed the less liable they are to move. But it is also a fact which cannot be questioned, that hundreds of dollars' worth of drops have been split and spoiled, because the keys have been made with so little taper that the forger could not ascertain by the resistance offered to his blows when he had driven the keys as tight as it was prudent to force them.

Some men have more sensitiveness than others, but it would seem that there was no necessity for depending upon a delicate sense of touch in such a rough matter as the driving of a key to hold drop dies. Well fitted keys, well oiled, of a taper one-fourth of an inch to a foot, can be driven as tightly into a cast-iron drop-hammer as the metal will stand, and the taper is still so little that the key will have no tendency to work loose, and at the same time great enough, so that most any one can tell by the feeling when the key is driven hard enough to hold.

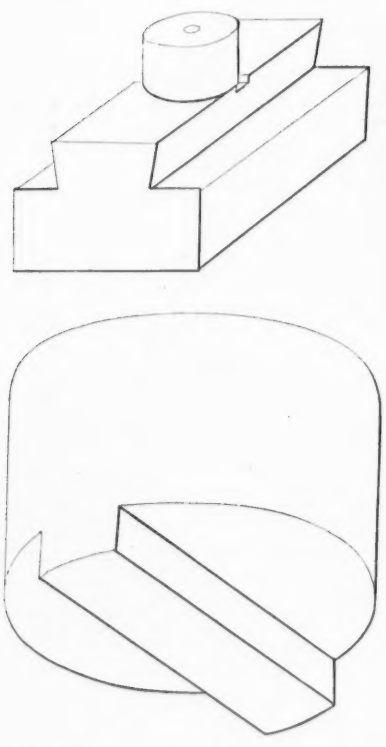
It is not often the case that men who run the drops have had the benefit of a full term of apprenticeship at the jobbing forge, and they are apt to neglect to keep the points and heads of their keys in good order. The points should be kept in good shape, so that the keys can be driven in and out easily, and without denting and tearing up the key seats. The heads should be kept in good shape because a misblow of the driver may knock off a piece, and a ragged piece of steel struck from a key is not a pleasant thing to have enter a person's flesh. The head should be kept in shape also, because it is often desirable to put a lining beside it, and then it should lay right flat, close up to it, and not be kept off by a bulging head.

It is, of course, a very nice thing to have all the dies so fitted that it is never necessary to use any lining, but where the proprietors are not in favor of throwing away twenty or thirty dollars' worth of steel because the planer has cut a little too much off from the tenons of the dies, it is just as well to bend a little and look in some other direction while the drop forger puts in a thin strip of

sheet steel to fill up the deficiency and make all tight. One strip is enough, thick or thin.

Dies used to be fastened into trip-hammers with the die seats just the reverse of dove-tailed; that is, the tenon would grow smaller at the top than it was next the die. To fasten these dies in, all that was necessary was to let the hammer down upon them and they wedged themselves in, or if they were too small, a bit of tin by their sides made them thick enough to hold. Old trip-hammersmen aver that they never had any serious trouble with this method of holding dies, but they do not seem to hanker for the old way after they have tried the dove-tail and key. The dove-tail is good about assisting the key to hold, because when the key is driven, its tendency is to draw the die to the bottom of the die seat, making three bearings, namely, against the two sides and against the bottom, while in a straight die seat there are only two bearings, and these are against the two sides, there being no tendency to force it against the bottom.

Keys should always be well fitted; caution should be observed not to drive them too tight in a weak head. To make it unnecessary to drive them so excessively tight, it is a good plan to put in a dowel-pin. Suppose the die seat in a drop-hammer is three inches across the middle, and that for the thickness of the key a half an inch is allowed, then in the center of the remaining two and a half inches drill a hole two inches in diameter and one and a half inches deep. This can be done with a ratchet drill without taking the hammer down. Now turn up a piece of steel two inches in diameter and one and three-quarters inches long, and plane off from one end of it, to the depth of a fourth of an inch, all but a strip through the middle, a half an inch wide. Then you have a piece something like this shown in the engraving.



This is put in the hole made in the drop and leaves the tongue 2 inches long, ½ inch wide, and ¼ inch deep, protruding for a dowel. The tenons of the dies have each a cut taken across them to correspond with the dowel, and when they are set in and keyed only lightly, the dies are held by the key and die-seat from moving sidewise, and by this strong dowel from moving endwise, and they therefore remain, without any excessive strain, fixed firmly in their position. For a trip-hammer die-seat, the diameter of the dowel pin may be less, but the dimensions of the tongue, as to width and height, are not out of the way. They have been used in hard work where the tendency of the dies to move endwise has, from unavoidable necessity, been very great, and they have proved good, and have enabled the workmen to use cast iron drop-hammers when, without some such device, wrought iron must have been substituted. Dowels are sometimes put in the sides of dies.

Cast steel, cast to pattern, makes certainly as good trip-hammer heads as ever were used. They are hard, and when carefully annealed are very strong and enduring.

Having had trouble with a positive stroke trip-hammer from the head beating up into the helve, and making the helve short lived, it was thought advisable to increase the bearing surface of the head, while it was not desirable to increase the weight. A pattern was made, flanged out wide and thin for a bearing surface, and a casting was made from this in iron for a temporary expedient, with the result, when put in use, that the weight of the flanges broke them off. The pattern was then sent to the malleable iron foundry, and a casting procured of malleable iron, which proved more serviceable. The flanges being thin, were converted into malleable iron for perhaps one-fourth of their thickness, but as it was known that more had to be planed out of the die-seat than had been "converted," it was rightly conjectured that the head would soon split from the strain of holding the dies, and measures were taken at once to procure steel castings from the patterns.

This was about four years ago, and it was about a month after the pattern was sent before the castings arrived. It was then found that the castings had shrunk away from the top in cooling. This same trouble had occurred with the melleable iron, and the steel founders had had their attention called to it, with the particular request to keep the casting full. Whether it could have been kept up by feeding or by a higher riser, or whether the shrinkage took place after the metal had cooled to such an extent that neither expedient could have prevented it, the fact was there that the casting was some quarter of an inch concave, when it should have been full to take a good solid bearing on the helve. A piece of hickory about an inch and a half thick was worked out so it had some bearing on the hollow place, and made a good bedding between the head and helve, and the hammer was set to work. The head lasted about half a day, and went to pieces like pot metal. Another head that was cast at the same time was then taken and given a good heat in an annealing furnace and kept hot, so that it was two days before it was cool enough to work. It was then finished up and put in, and is running now.

The cause of the breaking of the first one was thought to be a want of proper annealing. It was not kept long enough cooling from one stage to another to give the molecules a chance to adjust themselves to the tension of contraction, so when it had arrived at its normal temperature it was on a strain like a strained bow.

If now the temperature had been carried much lower, say to 150° below zero, and then the temperatnre gradually raised to its normal state or to the temperature of the surronnding air, it might be that this strain would have been relaxed, as when a violin string is screwed up to too high a pitch, the tuner pulls it a little with his fingers, which straining it more causes it to be somewhat less tight when he lets it go, and consequently lower in tone. Instead of trying this plan the opposite one was adopted, of raising the temperature and letting it cool back again, and the results were such as seemed to verify the hypothesis upon which the remedial measures were based.

Since then the same course, substantially, has been pursued on other heads for other hammers, with the same results. To get rid of the concavity mentioned, the pattern might have been convexed to about the amount which experience showed was required to make it come level after shrinkage. Delusive hopes that the foundrymen would send "castings made to pattern" prevented, and the difficulty was removed by the blacksmith, who heated it and worked the hollow out as he would from any other forging, by hammering down the high outsides with not too big a hammer until they were as low as the hollow.

It becoming necessary to renew the pawl on a Peck drop lifter which had run some six years, it was thought best to try cast steel, cast to pattern. The first which were tried did not last, and the pattern was reinforced in the weak points to as great an extent as its situation in relation to adjacent parts would allow, and after exhausting all expedients that occurred to a party that never liked to give up that anything had failed, it was admitted that for that place good hard iron was of greater utility. One made of a piece of locomotive drive wheel tire did the best. One reason why the pawl should not be too stubborn is that it is more easily replaced than the ratchet and should for that reason be the less durable.

A punching die for punching a 1¾ inch hole which was made of the ring of one of the discarded steel pawls has been used for punching some 20,000 pieces of iron ⅝ thick and—barring accidents—is good for as many more. The steel seemed to be lacking in tensile strength but still has qualities which make it a good die.

There is some talk occasionally of steel which will work as easily as iron, and will harden as well as any steel. Is there anything that answers this description any better than blister steel or its modification shear, and double shear steel? Some Swedes iron will harden well. Some common iron we get will harden well. It will not do to dip in water the forgings made from it while they are hot, because they harden so hard as to spoil expensive finishing tools, but the trouble with this iron is perhaps that the puddlers have not worked it as thoroughly as they should have done, or it has not had the proper treatment since in its manufacture. When it comes to placing dependence upon the hardening of work and risking the reputation of a manufacturing establishment upon the capability of a piece to be hardened it is well to keep track of the material by frequent trials, and it is not well to place too much dependence upon the word of parties who are interested only in selling their goods. They may think they make a uniform grade, but sometimes their workmen get uneasy from some cause, and do not feel and take sufficient interest in the product of their labor to prevent them from slighting things which require attention. This is a thing to be deplored in our country where the art of steel making is comparatively young. Painstaking workmen should be encouraged, and those, who without any grievance to complain of, slight their work and neglect their duties, have either been wrongly brought up, or never had conscience enough to fit them to follow responsible mechanical avocations. There is nothing any more aggravating than a want of uniformity in steel which is bought for a certain grade.

In a large Eastern city, certain parties invested capital, got half a dozen drops to work and a large amount of other machinery, and made the handsomest adze-eye claw hammers that were ever put on the market. These hammers flourished awhile, and their neat, workmanlike appearance caused a great demand for them. They sold on their shape with great rapidity for awhile, but all at once they began to come back. They were so hard they could not be filed, but this hardness was only a skin, and beneath that they were soft. The skin was of no use to them as hammers, for it did not prevent their battering up, and all that had been made were worthless, or at least so large a proportion were bad that it hardly paid to inspect them as thoroughly as was necessary. That steel would work almost like iron, but that concern soon ceased to make Maydole hammers.

If some concerns, in the same business of longer established reputation, are able to pull through against the same disadvantages, it is only owing to the favorable condition of the time. The damage they receive from letting some classes of their goods go out without sufficient inspection may some time be of serious injury to them. It is not enough that they honorably make good those which prove bad. People do not like to appear captious, and hesitate to return bad work. They prefer to get what experience has proved to them to be good.

A Troy stove house advertises for a traveling salesman with a brass check, duplex coat, tile hat, cork-screw pants, can-opener shoes, and requires him to polish them with Star paste. He must be lined with iron-stone, and swear they had the patterns made for a high-art and low-feed stove six years ago, and that they are the original "Jacobs."—*American Artizan.*

Upwards of four years ago a board of naval officers was appointed by the Navy Department to report on the capability of an air-refrigerating machine to completely ventilate the entire interior of naval vessels with cool, dry air. The object sought was increasing the health and comfort of inmates, the preservation of food, and enhancing the durability of the vessels. Exhaustive experiments were made four years ago with an air-refrigerating machine used in the market at the foot of West 34th street, in this city. The official report of these experiments has just been published by the Navy Department, and is called No. 1 of a New Series of Steam Engineering Papers. No. 1 is an interesting and instructive paper.

Trial of a Road Locomotive for Pulling Capacity.

A traction engine, manufactured by the Harrisburg (Pa.) Car Manufacturing Co., underwent a public trial on Wednesday, August 1st, 1883, at Hummelstown, Dauphin County, Pa., as regards its hauling capacity for conveying stone from the quarries of the Hummelstown Brown-stone Company to the Reading Railroad Station of the above place—distance, three miles.

The traction engine, filled with water, weighed	10,850 lbs.
Weight on front wheels.....	3,725 "
Weight on drivers.	7,110 "
Weight of tender, including water and coal.....	2,520 "

The locomotive started from the station at precisely 10 A. M., and proceeded over the usual route taken by the company's "muel teams," without any load attached, at a speed of about five miles an hour.

The performance, in running out Main street, was every way admirable, and the run up the hill, just before reaching the quarry, was accomplished with ease, the steepest incline being about *one in five*, or seventeen inches in eight feet.

At the quarry a wagon loaded with stone, weighing 11,500 lbs., was attached to the tender, making a total load of 14,020 lbs., including water and coal on the latter.

The locomotive started off at the rate of three miles an hour, overcoming the incline of the hill of *one in seven*, with but one stop, although the road was very sandy and much cut by the teams and recent rains. The "near" traction wheel cut into a hole filled with loose sand; but by backing and going forward, and in the meantime filling the hole with small stone, the wheel was finally lifted high enough to run off upon the hard road-bed on its journey again.

The run down the opposite side of the hill, *one in five*, was at the rate of six miles an hour, and under perfect control, without a slipper being attached to the wagon wheels.

On entering the Main street of the town, the engineer accidentally run the hub of the "off" front wheel against a post planted on the street, and the shock broke the "fifth wheel," thus bringing the trial to a sudden end.

The run from the foot of the hill to the town was much admired by many practical mechanics.

The locomotive is of ten horse-power, and was built for agricultural purposes.

An association of stationary engineers has been formed in Leadville, Col., and Jersey City, N. J., since our last issue went to press. This makes thirty-eight associations now tributary to the National Association.

In the Cooke Locomotive Works there is a magnetic machine kept running to separate the iron from brass and copper turnings. It works well, and greatly improves the character of the brass made from this scrap.

Notes on a Steam Pump Works.

A recent visit to the Henry R. Worthington Hydraulic Works, at Brooklyn, where between six and seven hundred men are at work in the manufacture of direct-acting steam pumps and pumping engines, establishes faith that this particularly American industry is not languishing. An observation of the work as carried on in these shops is of interest in a mechanical point of view as showing the influence of system in cheapening the cost of manufacturing something that has reached the stage of being a specialty.

As an instance of how it may often be possible to do two things in about the time required to do one, it was noticed that the two cylinders of pumps, cast together, were both bored at the same time, and substantially as quickly as one would be bored; also that the same cylinders on the planer were operated upon by four tools at once—two at the top and one at each of the sides of the pairs.

A very efficient arrangement was observed in use in drilling the cylinders, consisting of an angle plate with rollers or wheels that by an eccentric shaft and a lever, could be thrown below the bottom surface when it was desired to move the plate. In this respect the arrangement is similar to that sometimes used with the tailstocks of large lathes. On the vertical face of the angle plate is a plate that can be revolved on a projecting journal, and to this plate the cylinders are clamped. Holes reamed for a pin provide for locking the loose plate and the cylinders at each quarter-revolution, so that after drilling all the holes on one side the pin can be removed and the cylinders revolved a quarter or half around, and fastened by inserting the pin in a new hole. This is done in the merest fraction of a minute. The holes are all drilled to template, and under a radial drilling machine that reduces the time of adjusting, from one hole to another, to as near nothing as is practicable. In tapping the holes, no time is spent in squaring up and wrenching in taps, the latter taking the place of the drill, in the machine, and running at a speed that would suggest its rapid destruction, but which does not seem to seriously affect it.

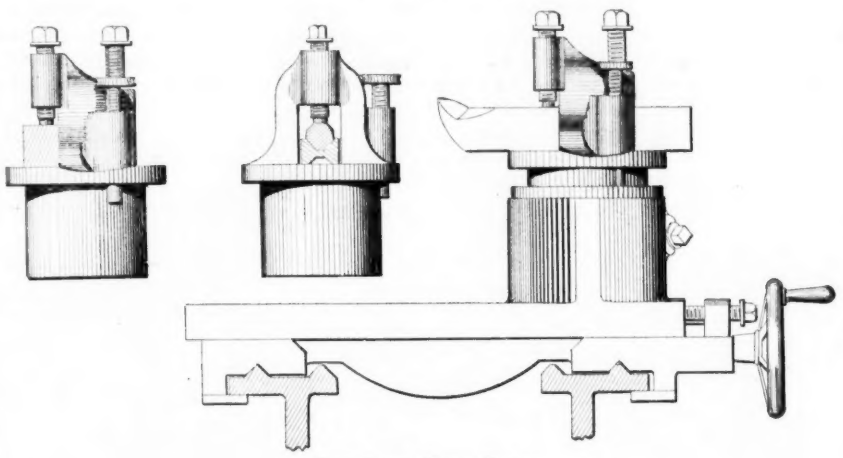
Although the subdivision of power for a large plant is sometimes spoken of as a new idea, it is very fully carried out at these works—the oldest of the kind in the country—every department being provided with its special steam engine. As the works have grown up from a small beginning to their present size by the addition of numerous buildings, this may in the first instance have been to some extent a matter of necessity, but it is adhered to now from choice.

With one of the engines a new form of condenser now being manufactured at the works, is used. For this condenser the water is pumped but is not elevated, the condenser being located wherever convenient. The water raised by the pump enters a condensing chamber, together with the exhaust steam from the engine, where the steam is condensed and the condensing water, together with the water of condensation, enters the pump and is discharged. The vacuum in the pump is that due to raising the condensing water from whatever depth it is raised, and is not, apparently, influenced by the vacuum in the cylinder of the engine.

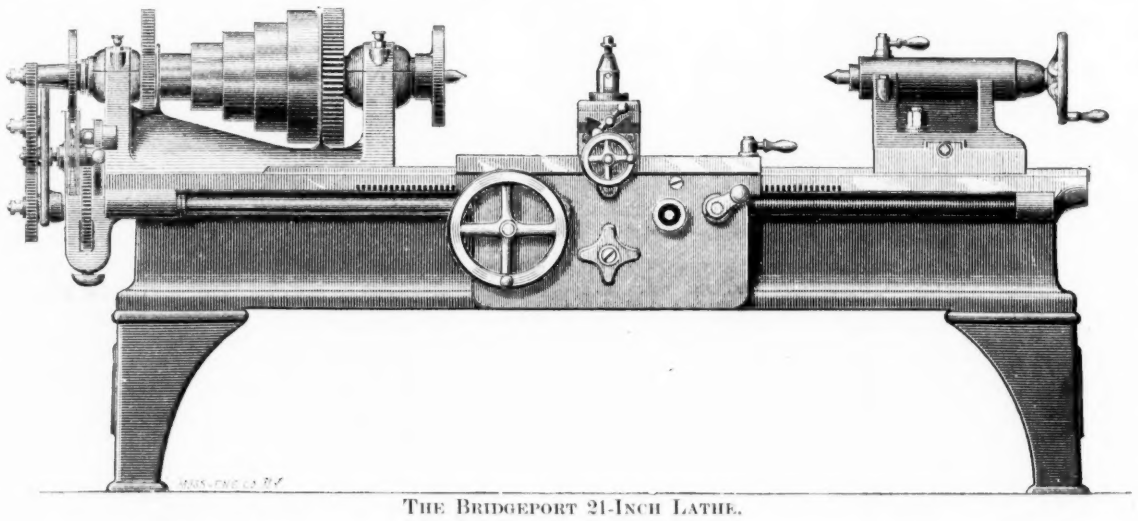
The foundry is a model one, especially fitted for the class of work done and excellently well provided with cranes and other facilities. The fine loam castings to be seen attest to the skill employed in this department.

Everything in the machine shop is done to gauge and templet, and really but few drawings are required in the shop except on some of the larger and less common work. Eight or ten draughtsmen, however, are required for the new work and designs being brought out. The templates are very complete, covering about everything done in the shop, not only so that the parts are interchangeable, but so that no time is spent in laying out work.

A good many curiosities of the earlier days of direct-acting steam pump engineering are to be seen about the works, amongst which are a pair of experimental blowing engines, evidently improvised from steam pump patterns. They are now, as they have been for a good many years, doing duty for the foundry, furnishing the blast for melting twenty-four tons of iron in a fifty-four inch cupola, in about three and one-half hours. The more recent buildings put up by the firm are excellent examples of their kind, the new machine shop and erecting shop with power cranes being especially good.



THE LIPE TOOL POST.



THE BRIDGEPORT 21-INCH LATHE.

The Bridgeport Lathe.

In our issue of August 4, a correspondent referred to a 16-inch swing lathe with the Lipe tool-post, that created favorable impressions at the Chicago Exposition by its capacity to do heavy work, instancing the reduction of a 5-inch shaft 1½ inch at a single cut, with coarse feed. With this we present an engraving of a 21-inch swing lathe, made by the builders of the lathe referred to, the Bridgeport Machine Tool Works, E. P. Bullard, 14 Dey street, New York; also engravings of the Lipe tool-post used with this lathe.

The head-stock of this lathe is made long for a five-speed cone pulley and 3-inch belt, the largest cone diameter being 13 inches. The gearing is 13 to 1, and the graduations of speed are equal for all of the ten changes.

The live spindle is of hammered steel, running in composition boxes, the front bearing being $3\frac{1}{2}$ inches × 6 inches. The tail-stock spindle is $2\frac{3}{8}$ inches diameter.

The carriage is 30 inches long, gibbed front and back, and is scraped to bearing the full length. The sliding tool-block is 18 inches long, with full length taper-adjusting wedge. It will face full swing of lathe. The compound rest can be attached to the wing of the carriage for turning full swing, and it will turn at any angle.

The leading screw is of steel, splined for operating the feeds. The lateral feed is engaged by turning the star to the right. By turning it to the left the cross-feed is locked, there being no possibility of locking the two feeds at the same time. The feed is driven by the Sellers friction disc.

The compound rest is so arranged that it can be almost instantly removed and the Lipe tool-post substituted in the same socket, giving the advantage of the plain rest for ordinary work. This tool-post is clearly shown in the engraving, from which its construction will be readily understood. By loosening the screw shown at about the center, vertically, of the outer shell in the right-hand figure, the tool may be raised or lowered, or swung around to any desired position, and again clamped by a turn of the screw.

The tool can be placed in the center of the tool-post, or at either side, as indicated in the left-hand figure. The advantages of this are too well understood to require comment. In the center figure is indicated the use of this tool-post for holding boring tools made of octagonal steel. Any size steel that will go through the slot may be held, providing for using as stiff and as short tools as possible.

We were recently shown, by L. C. Jewett, manager of Otis Brothers & Co.'s foundry, sheaves 24″ diameter, with several grooves for wire rope in each, that were cast ready for use and equally good—perhaps better—than those upon which several dollars were spent in turning out the grooves. The sheaves were cast from a whole pattern of iron, and it was a difficult matter in one just from the sand to find any evidence of a joint in the mould. It is purposed to cast sheaves up to 4 feet diameter, or larger, if required, in this way. The castings made at these works are among the finest to be seen anywhere. Among others was noticed a fly-wheel 4 feet 9 inches diameter, with a square rim turned and polished on the face and on both sides, and upon which it was impossible to find the least speck or flaw.

Quality of Iron for Steam Boilers.

There is so much discussion and controversy in regard to the real value of the different grades of iron offered in the market for boiler plates, that we have felt compelled to investigate the subject in order to ascertain what the brands used at present mean, and what quality of iron is indicated by them. We find that the brands as formerly used were:

C. H. No. 1, flange,	C. No. 1,
C. H. No. 1, shell,	Tank.

Some manufacturers were not satisfied with these brands because they did not indicate the true character of the iron, and boiler users were often deceived by having an inferior iron palmed off upon them by boiler-makers, when they supposed they were securing a first-class article. The brands were subsequently changed, and the following are those used by most, if not all, the prominent iron manufacturers in the country:

C. H. No 1, flange,	Refined,
C. H. No. 1, fire-box,	Tank.
Shell.	

If these brands are honestly used, the quality indicated is as follows, viz.: C. H. No. 1, FLANGE, and C. H. No. 1, FIRE-BOX, are strictly charcoal iron. SHELL has only a thin cover, or outer skin of charcoal iron. REFINED has no charcoal iron in it, but is simply refined from the pig. The pigs are selected with reference to the quantity of carbon which they contain. They are divided into *foundry* and *forge* pigs. Those containing the least carbon are selected for conversion into malleable, or wrought iron. The process of refining need not be described here. From the refinery the iron is usually run out into large moulds, and then broken up into what is technically distinguished as "*plate metal.*" Now the term "refined" iron is very indefinite, and means anything from "muck bar" to that which has been through several processes. The value of charcoal pig-iron, and charcoal blooms, is owing to their being produced with a fuel that is free from impurities, and while other irons can be purified it can only be done at expense and loss, and the danger is that, in some cases at least, it will be only purified sufficiently to "pass muster," and sell. The brand of "refined" iron in the market is often recommended as a superior article, because it is "refined," and the purchaser is led to believe that it is something unusually good.

Another test of quality is this: the price of refined iron at the time of our inquiry was 1¼ cents per pound less than the price of C. H. No. 1, Flange. The prices were: *Refined*, 3¼ cents per pound; *C. H No.* 1, *Flange*, 4½ cents per pound. Questions relative to the quality of boiler plate are frequently asked us, and we take this way of answering them.

We believe in the best material for boilers and always recommend it. We know that there is sharp competition in the business and that the margin of profit is often very narrow. But the purchaser should know what he is buying and be willing to pay a fair price for a first-class article. The purchaser is often as much at fault as the boiler-maker, by trying to get a first-class article for less than its cost. We know all reputable boiler-makers would prefer to use the best material and get a fair price for their work, and some will not make estimates if inferior material is called for.—*The Locomotive.*

According to *Engineering*, M. Harmet, a French engineer, proposes a new method of tempering steel tubes for artillery barrels. The present plan of tempering is to dip the barrel in oil when cooling begins simultaneously in the inner and outer surfaces. The effect of this is to create three different zones of cooling in the thickness of the metal, the central one of which only begins to contract when the two outer ones are already set. The tensions of the metal consequently vary towards a line in the middle of its thickness, instead of being concentric with the axis of the tube. The proposed remedy is simply to fill the tube with water, applying none to the exterior.

Moulding a Jacketed Cylinder.

BY THOS. D. WEST.

At the left of the engraving is shown a section of a jacketed cylinder, which will be recognized by the practised moulder as being a somewhat difficult casting to make. The outside of the casting is a simple affair enough, the difficulties being confined almost entirely to the center core, which is shown in section on the right, together with the sweep and other accessories used in its making.

In making the mould the outside was made first, not because it is customary to do so, but because it had to be built up and dried in a pit, from a lack of oven room. At *K* is shown the bottom plate; also a holding down hook, of which there are four. The plate was set on a solid sand foundation, and in order to leave a pit below a cast-iron ring *F* was used. The pit was required to provide room for a man to operate screws for centering the center core, as will be explained further on.

In making the outside mould there were five 6″ round blocks distributed so as to equally divide the circumference, for making vent holes as at *H*. At *Y* is represented a plate placed upon the top of the mould to stiffen and hold the brick-work together, After the mould was finished and blacked, it was then prepared for drying by laying four railroad bars across, so they would rest upon the pit about 4″ above the top of the mould. On top of these were placed sheet iron plates, and the open portions of the pit, between the rails, were bricked up to prevent the escape of heat. Charcoal and coke were used for drying, the charcoal on the outside and the coke on the inside. For the first twenty-four hours there was a fire upon the outside only, because both fires would, at the beginning, have been likely to have blistered the mould. The coke fire was made in a perforated boiler iron kettle, about 18″ diameter and 24″ deep; the kettle having an open top and fire-grate bottom, and being let down until the top of the fire was even with the bottom of the mould.

The pit was originally some 15 feet in depth, having been made for other purposes, and then filled up so as to be 8 feet deep The bottom of the small inner pit *F* was 3 feet below the bottom of the large pit, the diameter of the small pit being 42″. The diameter of the large pit was 13 feet. Upon the bottom of the large pit a boiler iron curb was placed. This was to make the pit smaller at and towards the bottom, to confine the fire and also to save work in ramming up. The distances given in engraving are not in all cases the actual ones, but are those it would be desirable to have for convenience of operations.

It may be asked why, if there is room enough at the bottom of the pit, it should not be made the same size at the top?

In answer it may be said that the sand requires harder ramming at the bottom than at the top of a mould, and sand can more readily be rammed solid in a small space than in a large one. Besides, while it is practicable to ram the small space at the bottom, if this space were continued to the top there would not be room to work to advantage.

In fitting up old pits for drying moulds, where a natural draft cannot be had, a blast-pipe may be laid all around the bottom, having a branch *E* passing up to the top through which connection is made with a blower or fan.

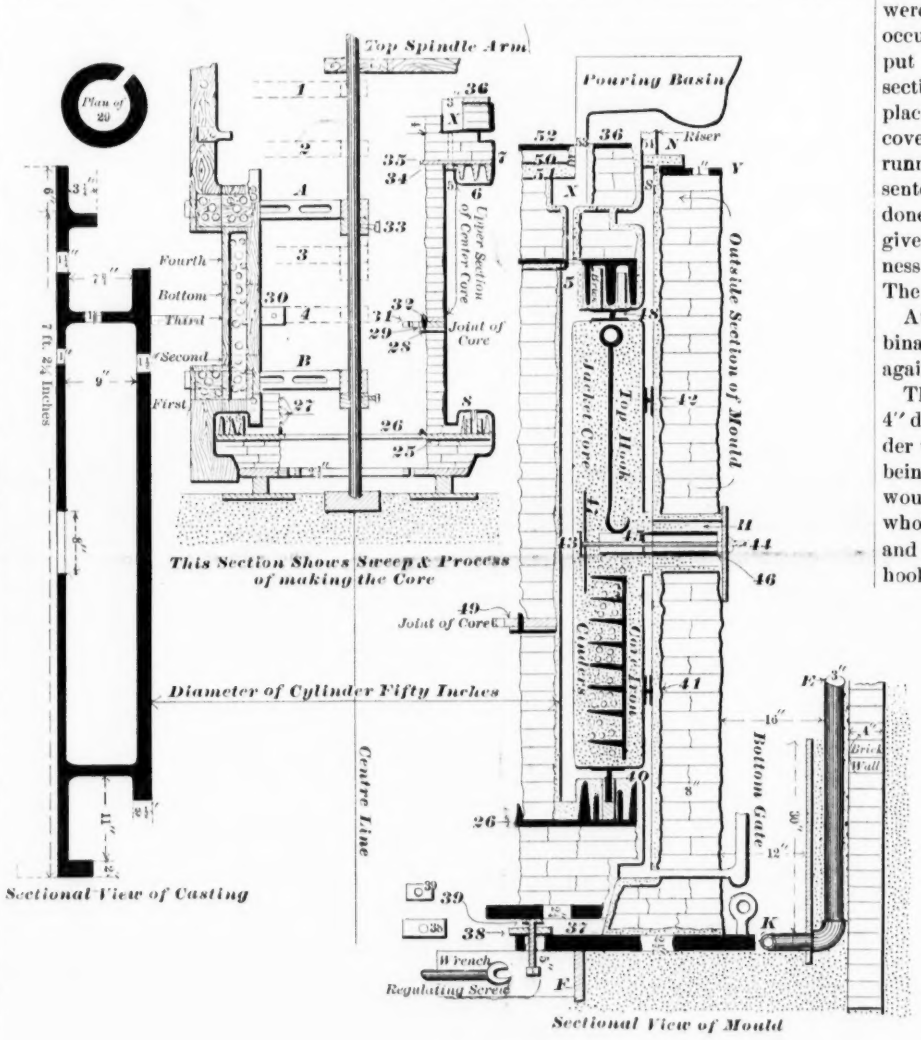
In firing up on the outside of this mould six to eight bushels of charcoal were evenly distributed on top of the blast-pipe *K*, which had small holes bored in it. The fire was started by throwing hot coals on the charcoal and putting the blast on.

After the fire was well under way the blast was shut off. The mould was uncovered every 24 hours and fresh fuel added until it was found to be dry.

In making the center core of this mould the sweep was in sections so that parts could be detached as required.

In commencing the sweep was secured to the arms *A* and *B*, as shown. The bottom plate having been leveled and centered, the core was then built up to a point indicated by the figures 25. The first section of the sweep was then temporarily removed and the plate 26 put on.

The space between the prickers 3 and 6 was packed with bricks, with a good layer of cinders under them Bricks 27 were then built up, after which this portion was loamed up. The first section of sweep was then permanently removed and the arm *B* moved up to 4. The core was then bricked and finished up to the joint 28. The lower joint ring 29 was then set on, which was done without removing the ring because of the opening in the latter, seen at the top in the left-hand side of the cut. The ring being in place a small sweep, 30, was bolted to the arm and a level joint swept up. This sweep was then taken off and the second section of sweep unscrewed and taken off permanently. The bottom bed, 8, was then covered with parting sand, over which was placed 2″ of moulding sand. This was done to protect this part of the mould from pieces of brick and from wet loam liable to fall when building the upper part of the core.



In the next operation *B* was moved up to 3, and after being bolted the arm and sweep were run up above the joint. The top spindle arm being removed, the joint lifting ring, 31, was lowered by the crane to place, there being three pins, one of which is shown at 32, for guides. The sweep was then let down to place, and the top arm secured; the collar, 33, not having been moved, the sweep was necessarily in the correct position.

The core was then built and finished up to arm 3, the third section of sweep taken off, and arm *A* moved up to 1 and arm *B* up to 2. The core was then built and loam finished up to 34, the fourth section of the sweep taken off, the top arm removed, and sweeps and arms *A* and *B* taken off the spindle The ring, 35, was then set on, the arms and sweep reset and the top arm secured, after the ring was centered. The fourth section of the sweep was then reset, the bottom being omitted. The under and side portions of 35, as at 5, 6 and 7, were now swept up or loam-finished.

It may be here stated that ring 35, before being set, had the space between the prickers packed with brick and the surface daubed with loam, the whole being dried in the oven This provides a body for absorbing moisture, making the sweeping at 5, 6 and 7 practicable.

The underneath sweeping being completed, the fourth section of the sweep was permanently removed. Arm *B* was now carried up close to *A*, and the remainder of the core finished.

The location of the upper arm should be higher than shown, to allow of completion of the core without further moving up of the arms.

In building and finishing the portion above 35, a layer of cinders was used on top of the plate. The dotted lines, extending from *X* to 5, show the position of runner gates, built about 15″ apart. *X* represents a basin, made when building the upper part of the core. At 36 a ring plate is represented, which was used for the purpose of giving support and a body from which to wedge down the core in getting ready to cast. The completed core was then parted, and after the joint was pinned and finished it was placed in the oven to dry.

The sectional view shows the mould closed, to be prepared for casting. In starting to close, the center core was lowered, a section at a time, into the mould. Then by four regulating screws, one of which is shown at the bottom plate, the core was adjusted to show equal space all around the riser head *S*. After the core was centered, the space between the plates, as at 37, was carefully and solidly packed with brick and loam, as a safeguard against run-outs.

At 38 and 39 are shown a plan and section of nuts for the regulating screws. The two views, 39, show a block with a conical hole to allow the point of the screw to move, thereby preventing throwing the bottom of the core out of the center of the mould when clear of the print. After the bottom joint had been secured as described the upper section of core was hoisted, and all the chaplets set. There being five cores to set so as to leave a thickness of iron between them all, the chaplets require to be divided equally. The bottom chaplets, shown at 4, were set in an iron stand, which fits into still another stand that is cast with plate 26. This plan makes the moving of chaplets impossible. The chaplets had ¾″ stems, with plates 4″ × 6″, and for each core three bottom chaplets were used. Four side chaplets were used for the sides of each core, two of which are shown at 41 and 42. A half-inch bolt, as at 43 and 44, was used to hold the cores against the chaplets. At 45 is represented a hole connected with cinders, and at 46 a tube 3½″ diameter with the end tapered to fit tightly in the core vent-hole. The space *H*, between the tube and mould, was rammed all around with sand, to prevent the metal getting into the vent tube. At 47 is a plate 3″ wide, ½″ thick and 18″ long, placed in the core to give support to the bolt head. The space in front of the bolt head was filled with beer sand, and made level with the surface of the core.

The cores being secured, the next operation was to arrange for chapleting down the cores, which was done as follows: On top of each core three clay balls were set. The upper jointed section of the center core was lowered down, as at 49. This section was then hoisted and chaplets were made $\frac{1}{16}$″ shorter than the clay balls measured. All the clay balls were numbered, and only two or three removed at a time, so as to insure against getting them mixed, as any blundering in this respect would probably result in losing the casting. When all the chaplets were placed upon the exact spots previously occupied by the clay balls, and a little flour put on to insure their touching, the upper section of the center core was lowered to its place, after which the riser head *S* was covered with segment cores, as at *N*. The runner basin *X* was covered over as represented. After the core was dried (being done one day before it was wanted) it was given one night's firing, to expel any dampness the course of brick, 50, might contain. The segment cones, 51, were dry when set.

At 52 is shown an iron ring, used in combination with 36 for wedging down the core against the high head pressure.

The pouring basin had one runner, 53, 4″ diameter, leading to basin *X*. The cylinder weighed a little more than 8 tons, there being flanges that are not shown, as they would serve to confuse the subject. The whole mould was secured by a cross-beam and slings, chains coming down to four hooks, one of which is shown at *K*. Enough iron was poured in at the bottom of the mould to fill it above 40 before any was poured in at the top. After the mould was poured and sufficiently cool, the basin *X* was uncovered and the basin iron broken up to assist the shrinkage as much as possible. The casting when finished was clean and without perceptible flaw.

There appears to be a curious fascination about trying to make steel direct from the ore. So soon as the young chemist or engineer gets to know that the chief difference between cast iron and steel is the impurities contained in the former, he conceives that it is possible to remove these impurities without going through the usual tedious processes. This has given rise to a host of patents which failed to accomplish the desired end. With particularly pure ores, steel is in some instances made direct, but poor ores are more difficult to manage. A new process has just been patented by an English metallurgical firm for making iron and steel direct; and as their practical experience is likely to prove of much service in developing an appliance of this kind, they may succeed in making it work with any kind of ore.

A Sand Wheel Motor.

The Virginia (Nev.) *Enterprise* notes a large overshot wheel operated by sand instead of water. It is located on a sandy plain, and it was at first proposed to drive the machinery by wind; but while, on the whole, this was sufficient for the purpose, it was too unsteady in its action, so the wheel was constructed and the windmill used by means of an endless bucket belt to elevate the sand to a reservoir, from which the flow is controlled to the wheel to give regular speed, in spite of the fluctuations of the wind power.

Improvement in Making Electric Lamps.

The accompanying engraving represents certain inventions to facilitate the manufacture of electric incandescent lamps. It is well known that the globe which contains the carbons in this form of light, has to be carefully deprived of oxygen to prevent the combustion of the burner. The usual method followed, of emptying the globe before hermetically sealing it has been to draw the air out with a pump. This never gives a perfect vacuum, and the principal aim of the invention illustrated, is to exclude the oxygen without using a pump. It excludes the atmosphere from the electric lamp during the process of finally treating the light giving body and sealing the glass enclosing bulb, and it seeks to ensure the required durability of the light giving body when put into use by having it surrounded in the globe with a rarified residuum of an inert gas.

The vessel *A* is made of cylindrical form, large enough to admit the globe *B*. Before being placed in this vessel the globe is filled with a hydro-carbon gas which entirely excludes the atmosphere. Hydro-carbon gas is admitted into the vessel *A*, at a suitable opening at *N*, and the escaping gas ignited at *I*, *I*, preventing the ingress of air into the cylinder. Carbonic acid or other inert gas is admitted into the cylinder at the point *S*, and fills the vessel. An electric current is now turned on to the imperfect carbon which, on reaching a high temperature, will take up a new supply of carbon from the hydro-carbon gas, building up the filament till it is rendered uniform throughout. This process being perfected, the globe is sealed by suitable means and the process is complete.

John H. Guest of Brooklyn, N. Y , is the patentee of this invention.

Exercising Machine.

An inventive genius has come to the rescue of that class of idlers who are becoming enervated through constitutional fatigue. He has invented and patented a machine for exercising and developing the muscles of mankind. We were always under the impression that a buck saw, vigorously operated, was a tolerably good means of muscle development, but in these days of æsthetic refinement that has become too vulgar. This new plan is a genteel, refined way of getting exercise Among the rising members of our cod fish aristocracy, anything in the shape of work is becoming unfashionable, and this new invention is intended to conceal work under the cloak of amusement. It consists of a combination of endless chain, crosshead, rods and gearing which a person can operate in an easy reclining position. Instead of walking out to face the bracing breeze in search of health and exercise, the purchaser of the exercising machine can recline in all the elegancies of down and velvet and go through the form of walking, the steps and pressure being all duly recorded.

A New Fuel.

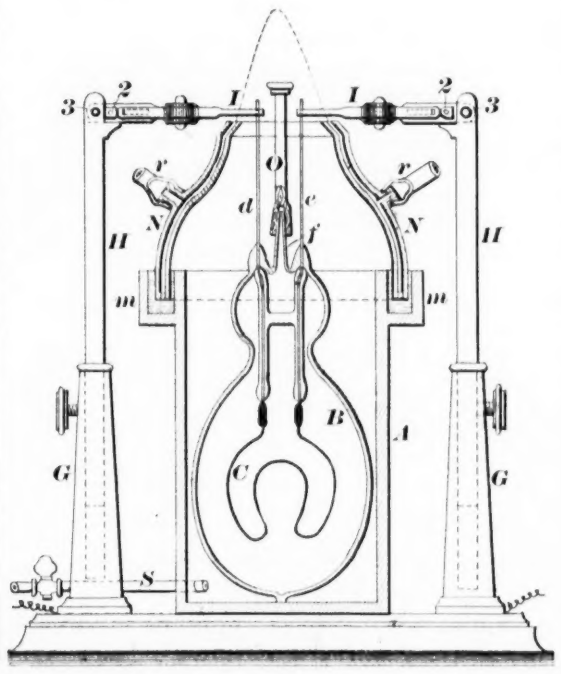
We learn from the *Mexican Financier* that a new industry is being successfully established in Mexico. The rapid extension of railroads into that country, with the increased activity in all departments of business, which usually follows railroad building in new territory, has made the scarcity of fuel conspicuously apparent. Wood and coal are both very scarce in Mexico, but peat exists in immense quantities, and a bituminous substance called chapopote is widely deposited throughout the State.

A compressed compound of peat and chapopote, which they call "turbato," has been patented and a large company has gone into the wholesale manufacture of this new fuel. It is said to produce results in heating steam boilers not much behind good bituminous coal.

We think that fuel deficient in carbon can be used to the best advantage by being burned in furnaces of large heating area. All sorts of patents and processes have been attempted, to mix up anthracite and bituminous slack coal, so that they could be consumed in ordinary furnaces, but in every case they resulted in failure. This new Mexican process may produce an article better fitted than peat for use in an ordinary furnace, but it is a case of making the mountain come to Mahomet. Making a furnace to suit the fuel is the most direct and natural method of dealing with the difficulty.

A Simple Nut Lock.

One of the most difficult places to maintain nuts and bolts in order is on the joints of railroad track crossings. The numerous grade crossings on the Philadelphia & Reading Railroad, which often have to be traversed by fast-running trains, caused no end of trouble for years. All sorts of inventions and makeshifts were tried in search of a remedy, but the bolts continued to break



IMPROVEMENT IN MAKING ELECTRIC LAMPS.

from the high tension of the nuts, or the nuts when moderately turned would work loose. One day it occurred to Mr. Wootten that something elastic was wanted to cure this evil, but at the same time the device must keep the nuts up to their work. As an experiment, he made a ring of tin about half an inch wide, and turned down the edges far enough to hold a lining of thin rubber. The ring, with the rubber lining holding the thread, was made to fit a ⅞″ bolt, and it was screwed up behind a nut on a crossing bolt. The ring is there to-day, and does its work in the very best shape. This sort of nut lock is now in use on all crossings and switches on the Philadelphia & Reading Railroad, and is found particularly useful in all points subject to much vibration. It is also an excellent device for keeping the nuts of valve stem and piston glands in place, and will probably receive much wider application as its merits become recognized. The device has been patented by General Manager John E. Wootten, Philadelphia, of the Philadelphia and Reading Railroad.

The *New York Tribune* says: "The plans for the new Chicago training-school modeled on the manual system, as taught in St. Louis, are completed, and ground will be broken at once at Michigan avenue and Twelfth street The first floor will contain the office, laboratory and machine shops; the second, school rooms the wood machine and wood-turning shops; the third, rooms for drawing and architecture, and the fourth, directors' and exhibition rooms. The amount needed to start the school has been subscribed by citizens.

In a lately patented scale for use in connection with the indicator (Ashcroft Manufacturing Company, New York), the width of the scale is made to correspond with $14\frac{7}{16}$ pounds. By this means the absolute zero line is drawn without measurement.

Extracts from Chordal's Letters.

THE MONKEY WRENCH—SOLID WRENCHES—EXPERIENCE WITH WRENCHES OF OTHER DESIGNS, AND IN DESIGNING WRENCHES—DROP FORGED WRENCHES — TOOL-POST WRENCHES—CONE-FASTENER IN LATHES.

Mr. Editor:

* * * In a late letter I referred to a monkey wrench as an excellent lathe tool, and some one has taken the trouble to say that a monkey wrench is an abomination around a lathe or anywhere else. This condemnation of the monkey wrench I believe to be a sentiment common to critical mechanics. I don't claim to be such, but I do claim an abiding faith in and an admiration for a monkey wrench. I don't mean somebody else's monkey wrench, with the back sprung and the premonition of a crack in the throat, and the screw gummed up so you want pipe tongs to move it, and a badly gotten-up cheap wrench anyhow; but I mean my own wrench, of good weight, a polished article kept in good shape, with the dirt kept out of the screw. I consider it a reliable tool every time.

* * * A good mechanic, in designing a machine, let it be engine, or loom, or planer, or cider mill, will look carefully to the uniformity of bolts and nuts. He will have as few sizes as possible, especially on those bolts and nuts which need to be turned often. As an adjusting wrench for such a machine a special solid-ended wrench might be the proper thing. But he who has to deal indiscriminately during the day with the engine and the loom, &c., must be independent of the wrenches belonging to the machine. The adjustable wrench embodies at least the proper idea, and it is a question of practicability that remains to be considered. As to convenience, there can be no question.

* * * In well-organized machine construction nowadays, the United States standard of bolts and nuts I believe is universally employed. Universally is perhaps a comprehensive word, but it is so near the proper word in this case that a departure is open to criticism. The formula is well known: distance across bolt-head, or nut, be it hex. or square, equals once and a half the diameter of the bolt, plus an eighth of an inch. This applies to rough or finished work; for all work is supposed to be completed as distinguished from finished when it goes out.

* * * A solid wrench which fits is an excellent tool. A sixty-fourth loose may be called a proper fit for a wrench upon a bolt-head. A wrench thus fitting may be used upon bright work without damaging the finish. If a solid wrench, by reason of bad original fitting, or by reason of weakness which permits it to open, is too large for the bolt-head upon which it is used, it possesses the sole demerit of the bad monkey wrench: that is, a failure to fit and a tendency to damage the work and slip, or slip and damage the work, whichever way you have a mind to put it. I believe a good monkey wrench kept in good shape in the hands of a mechanic (the only man who has any business unscrewing bright nuts), will be brought up to a fit within the sixty-fourth of an inch.

* * * This tendency of the monkey wrench is no more inherent in the adjustable system than it is inherent in ordinary construction of solid wrenches. In comparing the merits of the two tools they should be considered as designed with equal judgment and used with equal skill. It is a well known fact that a slip-shod man will use an open-ended wrench on any bolt which it will take hold of. He will use it on one three sizes too small before he will go five feet for one which will fit. He will have the corners of a bolt-head cutting into the faces of a wrench and getting it into excellent shape for damaging any other bolt-head on which it may be put. The same man would make an attempt to make a monkey wrench fit, but he might fail in his attempt because his general system of every-day operations has permitted his wrench to get so down at the heel that it can't be screwed up to fit any kind of a bolt-head.

* * * With all my respect for a 12″ monkey wrench, I will not pretend to say that I ever saw good ones of large size. Big monkey wrenches are too light, and if made heavy enough they might be considered too clumsy. I am willing to limit my respect to a monkey wrench 12″ or 14′ long, of good make and of heavy pattern.

* * * Monkey wrenches furnish a good test of the value of finish. I don't believe that a black monkey wrench in public hands can be a good monkey wrench; there must be a respectability of appearance to invite decent treatment; there must be a color which will show foulness. I believe a bright wrench costs from twenty-five to fifty cents more than a black wrench. It is worth three times as much

* * * A monkey wrench is necessarily broad in the jaws, and if you find a nut far down in a narrow crack the monkey wrench is useless. This is a failing of monkey wrenches. But it may be said that a solid wrench will not reach down in this crack if the wrench is too thick. In machine design these narrow cracks call for special wrenches.

* * * About ninety-nine lathes out of a hundred have got some place around the change gearing which can only be reached by a very thin wrench. In many lathes an ordinary solid wrench is too thick, as a standard nut cannot be used.

* * * I think it was in your own journal, Mr. Editor, that Prof. Sweet, some time ago, made a presentation of his own experience in dealing with a rational wrench. His novel wrench would strike a mechanical eye as perfection, but two points presented themselves at once. First and foremost, it took two wrenches to fit two bolts, if they were not of the same size, this being a difficulty inherent in solid wrenches; and next, the thing did not look enough like a wrench to be accepted. Its use involved a reasoning power, and was too apt to invite an application of popular science, and popular science is sure to get a wrench on wrong side to.

I think this was the Professor's experience, if I remember rightly; he even formed one edge of the handle into a cutting edge, so as to bruise the hand of the wrongdoer. This would not be an insurance of the proper thing, for thick headedness would rather walk through blood than do a thing properly.

* * * I was at one time employed in a machine tool concern, and found that machines as constructed were provided with solid wrenches, each designed after its own peculiar order of architecture. These wrenches were constructed as elements of the machine, and there was no association of manufacture between any two of the wrenches. I set myself to devise a system of wrenches in which I hoped to embody all that I could find in the best example in the hap-hazard lot. I gathered up all the one inch wrenches I could find in the shop and laid them in a row, then I added an inch wrench from Bement's shop, one from Sellers, Pratt & Whitney, Putnam Machine Co., Lathe & Morse, Billings & Spencer, the Fitchburg Machine Co., the New Haven Manufacturing Co., and some others I have forgotten. It was the queerest looking lot of wrenches you ever saw.

* * * The purpose of each wrench was to enable a man—any man—to manipulate an inch nut—any inch nut. But these wrenches took some very peculiar ideas of this purpose. The variations across the jaws, which, by the way, were quite noticeable, were to be accounted for by the fact that at that time all of these makers had not adopted a standard for bolt-heads and nuts. But the amount of metal in the head and the disposition of it, the depth through the angles where the strain comes, the amount

at the toes where the upset comes, the thickness where the bearing surface comes, presented as many variations as could possibly be wrought into that amount of metal fitted to grasp a nut. And the handles ran from 9″ in length to 20″ in length, and presented about all the sections that could be got into a bar of metal. And the tapers of the handles should be labeled various. Some were smallest at one end, and some at the other; some were parallel and some had a swell in the middle, and some had the other thing in the middle.

* * * One good thing about this array of wrenches lay in the fact that they were all old wrenches, and therefore exhibited their behavior in practical use. Some of the wrenches had one jaw; some were bent and had been straightened; some had been broken and welded; some, I might say, all were slightly open and some were badly chawed up in the jaws. I devoted myself to the study of the head, and chose a form dictated by judgment and analysis, and approved by the observations of these old wrenches.

Such a matter had best not be mentioned in a place like this without a drawing, therefore I will attempt no description, but will only say that the bulk of the metal was thrown out from the inner angles of the hexagon where there is always an invitation to fracture, and, at the same time, a reasonable amount of metal was kept at the toes, if toes they can be called, so as to relieve the wrench of the charge of having a turnable feather edge. The thickness adopted for the head was that due to the standard thickness of bolt-heads, minus a reasonable chamfer—bolt-heads, not nuts, remember. The thickness of the standard nut equals the diameter of the bolt; the thickness of the bolt-head equals half its distance across.

I intended that these wrenches should go wherever there was room for a standard bolt-head. For the length of the wrench I chose fourteen diameters of the bolt, measuring from the center of the bolt to the end of the wrench. I cannot give any scientific reasons for this length. I can only say that by investigation I found that for machine tool-work this gave a length suitable for the proper tightening of any bolt, and that it did not give a length which would result in stripping a bolt. By calculation afterwards it proved to be very near an average of the length of the many wrenches I had been figuring with. In the taper of the handle I was guided by common sense, and I think I made an ugly wrench. The handle was largest at the wrench end; it was a flat lever, round at the end and round at the edges, and of a thickness and width arrived at by a mixture of figures and experiments. The juncture of the handle to the head was carefully filleted to avoid internal angles likely to lead to fractures. I will say that a great many of these wrenches, of sizes from $\frac{3}{8}$″ to $1\frac{1}{4}$″, have been made and used, and have proven as good as the best and no better. They were reduced to a system of simple manufacture, and of course were very much cheaper than the mixed lot of wrenches they superseded. The system of manufacture was not carried very far, because they were not made in large quantities; but still it counted, and counted largely for such a detail.

* * * I said nothing of the material of these wrenches. It was first-class wrought iron case hardened; the forgings were die finished and emery-wheel finished, and the jaws milled. They were far from being handsome either in shape or surface.

* * * At the time I was working with these wrenches I investigated the drop-forged wrenches then in the market. Their elegance I have never yet ceased to admire, but I found them unavailable for my uses, because a range of sizes had never been provided for.

* * * I lately picked up a drop-forged finished wrench, recently put upon the market by a Flushing concern—Williams & Diamond. The wrench I saw was a small sample, for $\frac{3}{4}$″ bolts, I think, but the perfection of its make up was charming. It presented polished surfaces at the sides of the jaws only; the balance was the most beautiful case hardening. The nut-notch in the head was at a slight angle. It was not an S-wrench, but it had a slight leaning that way. I was at once taken with the perfect appearance of the wrench coupled with its price list—a matter that I was able to appreciate. I could not judge by this sample whether a whole set of these wrenches would be based upon a system of proper proportion, or whether the material in them was the proper thing, but I was informed that this wrench was a sample of a whole line, and that it had been thoroughly tested for strength.

These remarks may be advertising somebody's wrench, but if it is true that good, well-made, properly-designed, open-ended wrenches are to be found in the market at a price about equal to the cost of a decent finish in the jaws of a cast wrench, I don't see any special cause for withholding the mention.

* * * As an offset to any advertising that there may be in this article, I wish to enter my protest against the use of these wrenches or any other open-ended wrench as tool-post wrenches for lathes. How a machine-tool constructor who has ever run a lathe himself can deliberately and premeditatedly and with malice aforethought neglect to provide his lathes with box wrenches for the tool-posts would be a mystery in the absence of a dollar and cent explanation. There is always something about a lathe that a box wrench won't answer for; and, of course, if the box wrench goes with the tool-post, an open-ended wrench would have to be provided for these other screw-heads. This might cost 25 cents more—25 cents accounts for lots of things in this world.

* * * Apart from the tail-stock wrench, which may be considered as a part of the tail stock, lathe makers generally arrange that there shall be but two sizes of adjusting heads around a lathe—one a standard hexagon, the other a square set screw head for the same size bolt. The hexagon is at the change gear and the change gear quadrant, and the carriage clamps, if there are any carriage clamps, and at the clamps and jaw bolts of the steady rest and follower rest. The squares are at the tool posts, the main journal caps, the elevating screw, if there is any, the elevating rest clamp, if there is one, the set screws at the steady and follower rests and the cone binder in the spur gear. This last-mentioned screw is the one which defeats the use of the box wrench. If that screw could be managed some way, the square box wrench and an open hexagon wrench would fill the bill, and still save the 25 cents, perhaps.

* * * Speaking of the cone fastener in lathes, it does seem wonderful that up to a few years ago this arrangement should have consisted of a round pin stuck through two holes. Too much cannot be said of the marvelous advance in mechanical engineering, evidenced by the contrivance of the present screw arrangement, which will enable a cone to be locked and unlocked without pulling something out by the roots, to be laid away carefully for future use. Or of the second step in the advance, which enabled this screw arrangement to be operated on with faith in what was inside the cone, without danger of unhitching something which would necessitate the tearing of the head-stock to pieces so it could be fished out.

* * * The engine lathe, shown in draughting books as a type of ideal machine construction, is a fine machine. It is never more than 20 years behind the times.

* * * Who does not remember the old pin stuck through the spur gear into the cone through a quarter of an inch of metal in each, perhaps. The elegant fit of this pin when new was to be admired, and the continued elegance of the fit under the influence of dirt was to be recognized. But still this pin, with all its perfections, was tricky. It had a way of working out when least expected, and in this behavior you could judge whether the designer of the machine possessed the proper amount of forethought. If this pin could work out far enough to hammer on the head-stock before it let go of the cone, the fellow that got it up was a dumb-head; if it let go of the cone before it hammered on the head-stock, there is evidence of a master mind in its design.

One of the tricks of this pin was to slip out when way down inside the head-stock. It had to be coaxed back with a stick or file, or something, which did not take long, to be sure, but did most always break the point off the tool by moving the lathe back a trifle.

* * * I ran a fine old lathe once in which the cone was held by one pin, and the back gear held in position by two more. I lost one of these back gear pins, and in the absence of any appropriation for pin money, I was led to the discovery that the cone-pin would fit in the back gear pinhole. There was brilliancy in this thing which never received proper recognition. The two pins did all that three pins could possibly do. If the lathe makers had only been as smart as I was they might have saved the cost of one of these pins. This, from what I remember of the old lathe, must have been as much as ten cents.

* * * The modern lathe builder uses a high-toned eccentric arrangement for throwing the back gear in and out, but has failed to provide any way to keep it in. If some of them would go back into the past ages for one of these pins, or its equivalent, to combine with their eccentrics, the step might be an advanced one. Come to think, I believe somebody builds a lathe just that way.

Very respectfully, CHORDAL.

LETTERS FROM PRACTICAL MEN.

Packing for Joints of a Steam Chest.

Editor American Machinist:

I saw in your issue of August 25th, under the head of Questions and Answers, a note from J. C. D., Scranton, Pa, asking what kind of packing he could use to prevent cylinder oil from working through the joints of a steam chest.

I have had some trouble similar to his in the past, but have found a remedy for it. It is the following: Make a putty of red and white lead, hammer until quite stiff, and spread on the joint. Cover it with very thin muslin, patting it down so that it will adhere to the putty; then put on the steam chest and tighten the bolts. Great care should be taken to draw the bolts down equally.

I think if J. C. D. tries this, he will have no further trouble. PACKING.

Valve Seats Wearing Hollow in the Middle.

Editor American Machinist:

Some friends and I have been holding an argument concerning the cause of locomotive slide valves wearing hollow in the middle of the seat. Out of twelve valve seats faced off there are ten worn hollow in the middle, some of them as much as $\frac{1}{8}$ of an inch. The other parties contend that the entire cause of this is working the reverse lever close to the middle notch, for the purpose of saving steam and fuel. I agree with them on that point, but I think the greater part of the damage is done by running with the lever hooked up when the steam is shut off. Take a road like the Vicksburg and Meridian, which is about 140 miles long with about 160 grades. Now, in making a trip, the engineer has to shut off about 160 times and let the engine run without steam. If he would put the lever in the forward notch every time he shut off, the wear in the full travel would be sufficient to overbalance the wear at the short stroke, which causes the hollowing in the center of the seat. Take the case of a switch engine. After two years' service, if you take up the steam chest cover it will be seen that the seat will be almost level, although it may be badly cut. This happens because the valve travels over the whole surface, owing to the engine working full stroke of valve so much. If the road engine had the valve traveling its full throw every time the steam is shut off, don't you think it would wear even?

JOHN MAHONEY.

[We think the practice of running an engine with the lever notched back when the steam is shut off most objectionable, and enough to wear the center of seats hollow in a short time. It has a tendency to turn the cylinders into air pumps, and they suck in grit from the smoke-box, which grinds up valve seats and cuts the cylinders very rapidly. Some engineers are rather injudicious in the practice of hooking back the links. It is right to take the benefits of expansion as much as practicable, but it is not economical to hook up the links when an engine is moving slowly under a full load. Money and labor will be saved by keeping the lever in full gear till the train is got under good headway.]

Tool Dressing and Tempering.

Editor American Machinist:

Permit me to thank Mr. Goodyear for his friendly criticism in your issue of Aug. 11. Mr. Goodyear represents the old side of the question, the identical old lesson that I was taught when an apprentice by my English ancestors, where, no doubt, it originated. His side of the question is so generally known and believed that it takes a great deal of courage to attempt to set up any other theory. I would venture the assertion that nine-tenths of the population of the United States believe that all defective tools are the result of overheating the steel. How natural it is for all who have occasion for the blacksmith's services to remind him, "That is a good tool. Be careful and not overheat it." I admit that Mr. Goodyear has the popular side of the question. I do not expect to make converts rapidly, but hope to start some thoughts in a new channel. While I am convinced of the correctness of my theory, it will be necessary to back it up with some proofs to, at least, interest others.

I have two cold chisels to dress and temper. I will do one according to the old theory and one according to mine. In the one done by the old theory I go to a proper blacksmith's fire, see that it is clean, and carefully heat the chisel to about a cherry red; then take it to the anvil and hammer it towards the necessary shape, repeating the operation until it has assumed the proper shape, when I heat it again and temper it. By my plan I take the other chisel and heat it in the hole of a scrap furnace, which has a charge of 500 lbs. of scrap in it. I heat it carefully to as high a heat as it will stand without burning the carbon—a heat that I cannot describe any clearer than I can a welding heat.

I take it to a 1,200 lb. steam hammer and draw it to the proper shape, and if it is a cherry-red heat when done, I temper it. If not, I take a cherry heat on it, and then temper it.

Now mark the difference. Each of these fires is capable of welding wrought iron, 1,342°, each capable of burning steel, each capable of consuming any amount of time in heating any article, according to the judgment and manipulation of the heater.

I do not wish to be understood as saying that a heating furnace is a convenient fire for dressing tools, nor that a steam hammer is a convenient hammer for the purpose, but what I do wish to make plain is that an unskilled man cannot properly heat steel, no matter what the facilities are, and that a skilled man can heat an ordinary steel tool properly, and not be over-particular about the facilities. I say heat the steel properly. That is a broad term. I define it as hot as possible without burning the carbon. A welding heat on wrought iron is 1,342°. Steel burns at 1,250°. My proper heat for a steel tool is 1,240°, as near as I can get at it. Now, almost any fire will heat to 1,240°, and the hottest fire has a point around the outside where that temperature is to be had. When a piece of steel is welded into a piece of iron, the temperature has to be raised to 1,300°, and yet the steel is not supposed to be burnt.

But says one, "It is the borax that prevents it." I say no, for that piece of steel at the point that gets no borax stands the same heat, and is the first to carry the edge, when the tool is put on the market, where the makers' reputation is at stake. In all cases where steel and iron are welded, the heat cannot be denied, nor the quality of the tools.

When a man has acquired sufficient skill to be able to weld steel and iron, he can properly heat steel, and has acquired the first step towards dressing a steel tool.

I have seen the strongest advocates of the old system working steel and burning it one-half of the time and underheating it the other half; still, believing that they were doing it just right all the time, simply because they did not have the requisite skill—that something that cannot be learned from books nor from others; that which enables the eye to measure heat as closely as a fine instrument will measure the parts of an inch.

Now a word about annealing. When I undertake to anneal a piece of steel, I anneal it; there is no guess-work about it. The process of annealing is part of my business, which I am expected to do satisfactorily.

Mr. Goodyear says: "Whenever a tool needs drawing to prevent the edge from crumbling, there has been something wrong with the heating, forging, tempering or hardening;" also, that "letting the temper run down leaves the extreme point of the tool harder than any other part, and if the point is just right, how can any part above be right?" etc. I will answer this by asking other questions. How will hardened taps and dies work? How will hardened drills work? Why, they wouldn't work at all; they would break. But says one, "They are different from lathe tools." I say not. They both require a cutting edge. Why are all tools drawn that require a keen edge, such as carpenters' tools, etc.? Make a razor and harden it, and you cannot put an edge on it that will shave. An edge is an edge. It is possibly not so noticeable on a lathe tool as on a razor, but it is the same thing in principle. Jim's tools "can be ground and re-ground many times." Talk about give-aways! Why does it require to be re-ground so many times, the degree of hardness being practically the same for quite a distance back from the point? Not because the edge turns, but because it crumbles; and the necessity of so much grinding is proof positive of the fact that something has been done wrong.

JOS. H. GARTSIDE.

A Machinist's Views of the Railway Exposition.

Editor American Machinist:

It may be a little late now, but I would like to give some impressions of the Railway Exposition as they struck a journeyman machinist. Entering from the north end one could not help being struck with the jumble of concrete mixers, valve models, car bearing grinders, windmills and the like, set down alongside of some of the best machine tools that America can produce. I imagined at first that this was the confusion due to an out-of-the-way corner, but when I got through the whole exhibition the same thing was apparent in every part, and the only words to express my feelings were Miss Ophelia's "Oh! how shiftless!" All this wealth of manufacturing America piled in one great heap, with no more of selection than the crowd in the La Salle tunnel at the time of the great fire! Click, click in every part of the building car couplers sounded continually, and very few of them worth anything. Is this the way with our merchants who are accustomed to exhibiting goods to the best advantage? Does a grocer put a sample of sugar, coffee and the like in each box of Bermuda onions? Do our dry goods men put a sample of five-cent print in every hole and corner of their premises and alongside their best goods? Not any to signify, for with them it is a matter of classification so that customers may be impressed with the immensity of the stock.

Several points of the display struck me as specially interesting. The Bullard lathe and elevating tool-post were closely inspected. The excellent display of pumps contained much to admire, but the work done by the best of them was defective for want of a supply of dry steam. The drill grinder shown by William Sellers & Co., with its happy-go-lucky grind everything way of doing business, will "fill a want long felt" in machine shops. And here I would respectfully call their attention to the need of an apparatus for grinding all tools with a straight edge for it would effect a great saving of time. The display by the Yale & Towne people of their hoisting and transferring machinery was very interesting; but for an observing machinist the model machine shop of Pratt & Whitney was the most attractive part of the Exposition.

I went round the Exposition with a party of working machinists who, like myself, were deeply interested in every new tool or novel shop kink we could see round. The polite attention we received from the representatives of the leading firms, was in marked contrast with the studied impertinence of several small concerns when they learned that we were not ready to purchase anything displayed. We all received benefit and instruction from the visit to the Exposition, and no observing mechanic could go round such a place without increasing his practical knowledge. F. C. D.

Making Chilled Tools and Tool Chills.

Editor American Machinist:

A recent inquiry in your columns about chilled cast iron tools prompts the following: I have lately made such tools for turning drums, sheaves, pulleys and work of a similar character and they are pronounced much superior to the best steel tools for the purpose. I send you an off-hand sketch, (Fig. 1,) of tools I have been making for grooving drums and sheaves. The same tool is also

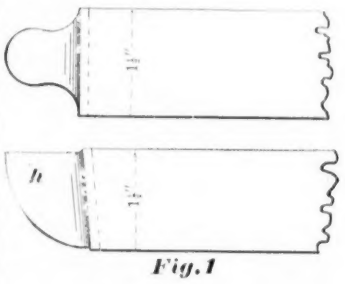


Fig. 1

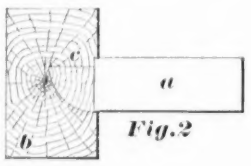


Fig. 2

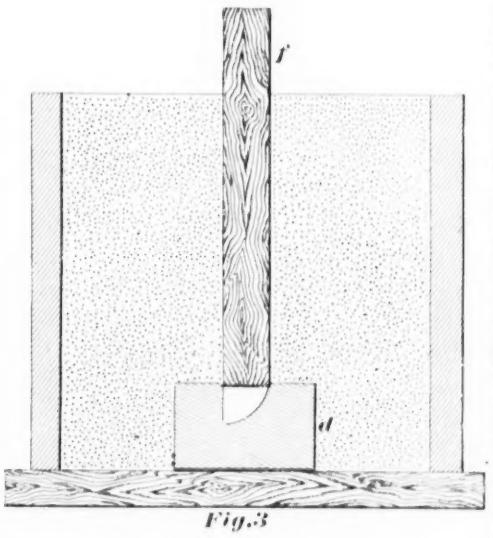


Fig. 3

suitable for general rough cutting. The way I make the chills is to have the machinist whittle out, or get made a pattern, *a*, Fig. 2, about the shape he wants his tool as to angle, &c.

It may be well to say that the edge should be backed with metal, as exaggerated at *h*, Fig. 1, as much as possible and leave the necessary clearance.

This wooden pattern is moulded and a casting made in the usual manner. The casting is filed up at the tool or cutting end just as it is required to be when cast in the chill.

Then take a block of wood, *b*, Fig. 2, four inches or so square and three inches thick, made as any pattern should be, and recessed to admit the tool up to dotted lines in Fig. 1. This square wooden block is the chill pattern. Place this pattern in the flask and ram up the drag with the iron tool oiled and in place in the pattern. Ram up the cope and draw the wooden pattern off the cast iron tool, which leaves the end of the tool projecting into the mould. Clean out all loose sand and pour the block. The iron will run over and around the tool, and if a little taper has been given, when the casting is cold the tool will drop out leaving the chill complete, as shown in section at *d*, in Fig. 3.

A chill might be made of any length and with any number of impressions for tools by using the same number of forms.

To make the chilled tool I get out a wooden pattern, *f*, Fig. 3, say 15 inches long and of the dimensions wanted (in the present instance 1½ inch square) and placing the chill in a deep flask and pattern in chill ram up and cast perpendicularly in open sand, as indicated. If the shank is too long break it off to length desired. Of course the wooden pattern must fit the chill nicely to exclude sand in ramming up.

I have made these tools from hard and from medium iron; also from the softest iron we use, but can see no difference in their cutting qualities. They should be ground on the top only, which preserves the chilled surface until the tool is ground away too far for further use; then put it in the cupola. I have never made any tools for use on a planer, and do not know whether they would or would not stand the sudden jar. For lathe work they are good and cheap.

FOUNDRYMAN.

Planer Speed—Time-Keeping Plan.

Editor American Machinist:

The allusions in your paper in regard to the return stroke of planers would be more interesting if the cutting speed in feet per minute were given. As yet I have seen nothing upon which to base any calculation as to the actual performance of the machines. I have a "Pond" planer, fifteen foot bed, which I have experimented with. Its cutting speed is seventeen feet per minute, and the return stroke fifty-two feet per minute. This I find to be a gain of about two hours per day over the original speed of the machine. Now let us have the experience of others in this line. If better results can be shown, I would like to know how it is done.

The subject of time-keeping is of vital importance to the manufacturer, and, as a rule, is sadly neglected by being left to some boy with no knowledge of shop practice, or a broken down clerk who can be hired cheaply, or to the workmen themselves. My experience as foreman has led me to conclude that the least concern the ordinary workman can have is in regard to giving in his time correctly. He never fails to impress upon your mind that he has worked so many hours, and there his responsibility ends. I once tried the experiment of giving out slates upon which I requested the men to set down the exact time spent on each job given them during the day, and what was the result? About one in ten had complied with my request. Some lost their pencil, some forgot it, and others couldn't remember whom the work was for. I send you a card which I am now using, which to my mind fills the bill. You will notice that on the front space is allowed for the number of the job, the workman's name, also the name of the party ordering the work done, while on the back I allow for keeping the time, also such items of material as may be used. Each job as it comes in is entered in a book kept for the purpose, with its number, the workman's name, and that of the customer. A card is filled out and given to each man having any part of the job to do. By exacting strict compliance with the printed regulations on the ticket, very few mistakes will occur.

It often happens that a workman will have more than one job in hand at one time—sometimes half a dozen—and here is where the importance comes in of having these reminders constantly before them.

When a job is completed I compare the time on the cards with my time-book, and if any discrepancy, the workmen are speedily called upon to explain. By so doing they will soon realize that they have some responsibility in the matter. FOREMAN.

Locomotive Building at Paterson, N. J.

Locomotive building is not so rushing as it was a year ago, but all the works are working overtime, some of them till ten or eleven o'clock every night. There appear to be orders enough in to keep the work going till about the holidays at their present output. Crops have been so good all over the country that an increased number of locomotives will soon be needed to do the railroad work, and orders will be given when the produce begins to move. This will give the assurance of steady work in locomotive building for the next year.

The Rogers Locomotive Works are engaged on engines for the Canada Pacific Railway, the Panama Canal Company, Denver and South Park Railroad, and several other roads. There is a group of double-ended locomotives of the Forney type well under way for the Long Island road, and one of the same kind goes to the Clove Branch, and others for the Georgia Pacific Railroad. These engines have slab frames 1½"x8" which connect with the bar frames just behind the back pedestals, and run back far enough to give room for the cab and coal space, this part being supported by a truck. They are very handy engines for short runs.

The Grant Locomotive Works are engaged on engines for the Pennsylvania Railroad, the New York, Lake Erie, and Western, and several smaller roads, mostly in the South. The engines for the Pennsylvania Railroad are heavy anthracite-coal burners, and they have a depression in the forward end of the fire box, with the view of carrying the deepest part of the fire there, where it has a tendency to become bare.

The Cooke Locomotive Works have still a number of mastodons to build for the Central Pacific Railroad, and the boilers for four of them are ready. They are working on orders for the Panama Canal Company, the Fitchburg Railroad, and several other companies.

In the Rogers Locomotive Works there is a quick and effective plan followed of truing wrist pins that have become slightly sprung in the process of case-hardening. They are put on the centers of a Brown & Sharpe milling machine, and an emery wheel is substituted for the milling cutter. This revolves at a high speed in the opposite direction from the pin, and the work of truing is done in a few minutes.

Jesse Walrath, of Racine, Wis., has patented an improvement on the steam engine. In his invention the main shaft passes through the steam chest of the steam cylinder, and actuates a cam or eccentric, which operates the slide valve direct. The steam chest is at the outer end, and in the axial line of the cylinder.

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NEW YORK, SEPTEMBER 8, 1883.

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False Reports of Dullness in Locomotive Shops.

Daily newspapers have lately been circulating sensational reports of depression in the locomotive building industry, holding forth the probability of some establishments shutting down from lack of orders. We learn by direct inquiry that these reports are false and misleading. Locomotive shops, as a rule, are supplied with orders for months in advance, and some of them are working overtime at night. Prices, it is true, are considerably lower than they were a year and a half ago, but the prospect is very good for work enough to keep them busy throughout the fall and winter, at least.

The circulation of false reports of lack of orders in locomotive shops may tend to depress prices of railroad securities, and perhaps wages of machinists and other workmen in those shops, otherwise we cannot see who would be benefitted by having them gain credence. Every report, whether true or false, that can be made to influence stock-jobbing operations is spread by a certain class of speculators to advance their individual interests. Press reports of sudden depression in iron or mechanical industries should be taken with a large grain of allowance during the next few months.

Protection for Russian Industries.

Until quite lately Russia has been regarded as a purely agricultural State which depended upon its neighbors Germany, France and England for all products requiring trained skill. During a generation or two back, Russia has been going in for manufactures to supply home needs, and now the growing native industries are about to receive the fertilizing influence of protection. A decision has just been published by the Minister of Finance declaring that in future all orders for locomotives and other railway rolling stock shall be given to Russian makers alone. In their railway system the Russians have imitated the American style of plant and operating to a considerable extent. They imitated our oil tank system by making tank cars for carrying kerosene, and now they have extended the same system to the transportation of alcohol. This plan is considered better than casks, as being less liable to leakage, accidental or induced.

Value of Statistical Averages.

Industrial statistics are often used in efforts to prove or disprove certain propositions, especially average statistics. The average reader of arguments based upon statistical averages is liable to be badly deceived. For instance, the regular stock argument of a number of daily newspapers and a still greater number of their weekly imitators, in favor of the unjust and injurious prison contract system, rests upon the very small proportion of prisoners engaged in any single occupation as compared with the whole number throughout the country in the same occupation. Everybody familiar with the influences that govern trade knows that one or two small concerns can, by persistently offering goods at lower than generally conceded market prices, disturb all the others in the business, and not unfrequently force a decline from the larger houses.

When trade is dull, the cutting of prices by one establishment often compels a hundred others to follow suit. A few small and weak manufacturers have the power to injure a large industry, even though they produce a comparatively insignificant quantity of goods as compared with the whole production of the country.

Let two or three machinery manufacturers—completing not more than one machine a month for each shop—offer, when trade is slack, to sell at lower prices than before, and as soon as this fact gets noised around a bad effect is experienced throughout the whole business. The extent of their production seems, in such cases, to bear no computable ratio to the extent of the mischief they are able to bring about. In a like manner other industries can be injured.

A knowledge of this fact, coupled with unpleasant experiences, has often caused the members of particular industries to form associations, where practical, for the purpose of mutual protection against irresponsible concerns in the same line, or those upon whom the generally accepted ethics of trade have made little impression.

The United States census returns, as to wages, value of production, capital invested, and number of operatives, have been used to apparently support some fallacious propositions. From these figures averages have been taken to fortify attacks upon our protective tariff and to show (to those ready to succumb to averages) that labor is poorly paid, and the manufacturing of certain articles enormously profitable But who would be deluded into entering an industry because of apparent heavy profits shown by census statistics?

One of our exchanges attempts to soothe those who have lost by certain bank failures, by showing that the losses by depositors throughout the country average less than a twentieth of one per cent Doubtless some of the victims will stubbornly refuse to be comforted by this assurance.

Wood for locomotive tank frames is getting to be a thing of the past. At Paterson, N. J., channel iron has been adopted almost exclusively in making tank frames, and timber is only used when the parties getting the engines prefer that material. Four longitudinal iron sills are used, the middle two holding the center castings and the draw-bar castings. All the structure is very strongly held together by bracing, and makes an excellent frame.

The Situation in the Iron Trade.

Several encouraging indications have been developed within two or three weeks to assure the iron trade that a large and fairly remunerative business will be transacted during the coming autumn and winter. Chief of these is the active inquiry in most branches. The trade exhibits more than usual caution and conservatism, but this is a good rather than a bad indication. In a general way, current wants are being provided for, and future requirements are permitted to wait. The aggregate consumption is large, notwithstanding the frequent complaints made in trade circles and in certain trade journals. The worst that can be said is, there is not a present demand for the full producing capacity possessed by the country, and hence "over-production" is talked of and apprehended.

Prices are not as strong as producers would wish. Greater care is necessary in dealing with a fluctuating market. The output of both crude and finished iron has been restricted during the past four or five months to the extent of some eighty blast furnaces, and a prolonged suspension of rolling mills. At present there is a backwardness among manufacturers to crowd the markets with iron—at least, until the fall demand can be judged of with more certainty than at present.

Railroad construction has fallen off largely this year as compared with last year, but for special causes and influences which will be largely removed as soon as the present involuntary liquidation in artificial values of railway securities has been accomplished. Railway material has declined to the lowest recorded limits. Rails are selling at $38 to $40, and negotiations for large blocks for winter delivery are in hand, which may fix prices for remote delivery at $36 and $37. Timber for railroad purposes has declined materially.

Cars, locomotives, bridge iron, tools, and all the small things which go into railway construction, are cheaper. Nearly all of the locomotive works have work for months to come. The bridge works are all supplied with contracts that will engage capacity to the close of the year or thereabouts. The larger car shops are crowded with fall orders, and a number of purchasing agents are now negotiating for material to be delivered during the winter and spring, especially for lumber.

The merchant steel establishments are nearly all well engaged, though none of them have their producing capacity crowded. Competition is sharp and prices are low. Refined cast is quoted at 11 to 12 cents, but sharp concessions are occasionally to be had. Tool steel continues in quite active request, and the demand for machine-shop requirements is large and steady.

The rolling mills are not fully occupied, and buyers of finished iron are afraid to place large orders on account of the decline which full production will inaugurate. Construction mills are better off, because of the active demand for structural and plate iron. Foreign iron is dull and in very light supply. Orders for shipments are few in number. The entire iron situation is satisfactory, though there is abundant room for improvement.

The future activity is largely dependent upon the amount of railway construction inaugurated. Agricultural and grazing lands, as well as mineral lands, are being purchased and settled rapidly. The abundance of railway facilities stimulates agriculture, and is leading to a rapid peopling of the remote regions of the country.

The attention of railroad men is being directed to locomotives that are adapted to the burning of coke as fuel, and the achievement is spoken of as a novelty. The claim is made that coke leaves no clinker on the grates, and that consequently it is better adapted than coal for long runs. To those who are interested in this subject, we would say that coke was burned almost exclusively in British locomotives for the first twenty years of railway operation. Coke was abandoned owing to its great expense as a fuel No special change was made on the locomotives to make them burn coal, except in providing greater accession of air to the fire. With new engines, a greater heating surface was provided for those intended to burn coal, and it did not require such a sharp blast as was needed to consume coke in a fire box. All that any of our locomotives need, to make them burn coke, is slightly smaller nozzles. But it is a mistake to say that no clinker will be formed when coke is used. This greatly depends on the kind of coal used in coke making, but we have found that some kinds of coke caused as much clinker as the ordinary run of coal.

Literary Notes.

The *Tradesman*, of Chattanooga, is an enterprising industrial newspaper. It is now publishing a series of portraits and biographical sketches of the "Progressive Men of the New South." Several generals have already had their portraits hung up, as it were, upon the front page, and last week the portrait of a colonel occupied the place of honor. If the majors and captains are patient, their turn will probably come to adorn the pages of our progressive contemporary.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(291) S. B. P., Hanover, N. H., asks: Can you tell me how to make small lenses without grinding and polishing? *A.*—We do not know of any satisfactory way of doing this.

(292) E. C. L., Allegheny, Pa., asks: Will a piece of glass 10″ thick withstand the pressure if sunk in the ocean to a depth of three miles? *A.*—We suppose you mean to ask if a solid piece of glass will be crushed if sunk to that depth. The crushing strength of glass is given by Trautwine as a mean of 25,000 lbs. per square inch, and the pressure of the water at a depth of three miles would only be about 7,000 lbs. per square inch. The conditions of the glass in the water would also be favorable to its withstanding greater pressure than if the pressure were applied in the ordinary way.

At what depth it would be crushed or disintegrated can only be determined by experiment, but it seems obvious that it would be several times three miles.

(293) J. M., Vicksburg, Miss., writes: Some two weeks ago I overhauled a Westinghouse brake which had been running 8 years. I took it all apart and bored out the large cylinders and put in new valves and packing all round. In place of making my large packing rings ¼" thick I made them scant $\frac{3}{16}$" and made all of the small steam openings $\frac{1}{32}$" larger than they were before. Put the parts together and tried the pump. When the steam-gauge indicated 25 lbs. the air-gauge showed 37 lbs.; and when the steam-gauge had 60 lbs. pressure the air-gauge indicated 60 lbs. also. Not having an opportunity of seeing a new brake work, I would like to know what is the lowest steam pressure that will make 37 lbs. of air? *A.*—Some of your gauges evidently were out of order. By boring out your steam cylinder you may have made its piston area so much greater than that of the air piston that 25 lbs. of steam would pump 37 lbs. of air. But when the steam got up to 60 lbs. and the pump was worked to its full capacity, the air pressure should have been proportionately higher.

(294) E. D., Brooklyn, N. Y., writes: In a book I have on the care of engines and boilers, I find something I am not able to see clearly. I refer to the instructions in the case of low-water. These are explicit as to the fire, but nothing is said about the water. I was recently called in to look after a boiler where the engineer had absented himself regardless of water or fire. It was a tubular boiler and the steam was so low that the engine had stopped. I tried the stop-cock in the glass gauge and found the water about level with the lower cock. The feed-water was warm, so I started the pump (there was steam enough to just keep it going) till the glass showed 2" of water. I then commenced firing till I got steam enough to start the pump again. What I want to know is, did I do right, and what should I do if the water was below the tubes? *A*—We infer that you satisfied yourself that the water was not below the tubes, in which case you did right to pump slowly. If the water is below the tubes, haul the fire or cover it up with coal and ashes so that no heat can come from it, and change nothing whatever around the boiler—that is, if the engine is running or steam being drawn from the boiler for any purpose, let it continue. If steam is shut off let it remain so, and wait for the boiler to cool down. Having prevented further heat from coming to the boiler, you have done all you can do with safety in the instance of water below the heating surface.

(295) H. S., Nashville, Tenn., writes: We have a good many gears to cut in the shop where I work, and I want to ask: 1. How shall I find the pitch of a gear, and the size of a blank for any number of teeth? *A.*—Cut gearing at the present time is almost exclusively calculated by diametrical pitch, the number of the pitch referring to the number of teeth for each inch in diameter; thus a gear of 8 pitch has 8 teeth for each inch in diameter, &c. The diameter must be measured from the pitch line, which is two parts of the pitch less than the total diameter. Suppose you want to make a gear with 50 teeth, 8 pitch; to find the diameter of the blank divide the number of teeth by the pitch (50÷8=6¼) which is the pitch diameter in inches, and the total diameter is $\frac{2}{8}$" or ¼" more, making the total diameter of the blank 6½". To reduce diametrical pitch to circular pitch divide 3.1416 by the diametrical pitch. Thus 8 diametrical pitch is 3.1416÷8=.392 circular pitch. 2. How do you set a common slide valve to cut off at ¾ stroke? *A.*—It is not generally correct to set a slide valve to cut off at some point in the stroke. In planning the valve motion the designer usually calculates where it will cut off, and in setting it it is set with the proper lead without reference to where it will cut off. If you wish to set it to cut off at ¾ stroke without reference to lead, you can turn the engine till the piston is at ¾ stroke and then move the eccentric till the valve just closes the port.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N.J.

The latest Improved Match Machinery is made by the White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

A. Wilkinson, expert steam engineer, Manayunk, Philadelphia, Pa.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, 25 ' lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Patents.—Franck D Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St, Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Parties desiring 18" engine lathes will find it to their advantage to correspond with James A. Fuller & Co., 3 Cyprus street, Worcester, Mass.

William J. Baldwin, consulting engineer in Steam Heating and Ventilation. Author of "Steam Heating for Buildings." Office, 96 Fulton st., New York.

Castings furnished for 18" and 21" swing engine lathes. Gearing turned and cut if desired. C. F. Batt, Phœnixville, Pa.

Guild & Garrison's Steam Pump Works, Brooklyn, N Y. Steam Pumping Machinery of every description. Send for catalogue.

How to reach 40,000 prominent "*Steam Users*" in the United States Send for our circular. The J. N. Mills Publishing Co., 145 Broadway, N. Y.

Young men wishing to take a mechanical course or learn the machinist's trade, call or address School of Mechanical Instruction, No. 195 Front street, Worcester, Mass.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, and 1882. A limited number of each sent by express for $4 per volume, express charges to be paid by purchaser. AMER. MACHINIST Publishing Co., 96 Fulton st., New York.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* injectors and best steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

The "Lancaster" new patent tools, viz., Screw Plates; Pipe Cutters, with and without Burr Scrapers; Wrenches; Pipe inside Burr Reamers; Drill Chucks; Combined Punch, Shears, Anvil, and Rod Cutters, &c.; all newly designed and highly efficient For agencies, illustrated circulars, and liberal discounts, apply to Lancaster Mfg. Co., 36 Dey st., N.Y.

We will pay 25c. each for copies of January 1st and 8th, 1881. They must be clean and in good condition. Any of our readers who are kind enough to send either of the above dates, will please write their name and address on the wrapper. AMERICAN MACHINIST Publishing Company, 96 Fulton street, N. Y.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00 Will be mailed and prepaid on the receipt of the price.

Credits.—Ealy's "Blue Book," July, 1883, just published, contains a complete classified list of over 100,000 names of machinists and dealers in machinery, railway machinists, engine and boiler makers' supplies, brass goods, metal, etc., in United States and Canada. The book is condensed making it much more convenient to handle than a larger agency book. It gives the financial standing and paying qualities of all dealers and manufacturers in the above-mentioned lines of trade. For terms, etc., address The John W. Ealy Company, 51 Chambers street, New York, or 79 Dearborn st., Chicago, Ill.

MANUFACTURES.

Peter Wohler is to erect a $40,000 2-story factory at No. 521 Twenty-first street, Chicago.

H. E Hooper, Denver, Col., writes us that he shall probably start a match factory in that city.

Iron and steel works are to be erected at once at Gunnison, Col., the company having a capital of $5.000,000.

The Chattanooga (Tenn.) Manufacturing Company are enlarging their works and will shortly double their capacity.

W. H. Warren, Worcester, Mass., has got out a new heavy 14-inch stroke traverse head-shaper, and is busy.

The proprietors of the Union Drop Forge Works at Chicago, Ill., anticipate an early extension of their plant.

The Terry Clock Company, Pittsfield, Mass., are to erect a factory 150 feet long to be ready some time this fall.

The Scranton Steel Company have been rolling rails which weigh 70 pounds to the yard and are 120 feet in length.

P. Cordrey, Massillon, Ohio, has just fitted up a machine shop to manufacture a railroad dump-car and ballast car.

The Roane Iron Company of Chattanooga is preparing to add an extensive nail and spike factory to its other business.

J. R. & V. Demerest, of Cresskill, N. J., are adding more power to their works, and are putting in a new 60-horse power tubular boiler.

Jonas S. Heartt & Co., of Troy, N. Y., car-wheel founders, are enlarging their machine shop to more than double its former size.

The Delaware, Lackawanna and Western have opened their new shops at East Buffalo, N. Y., with a force of 50 men, which number they expect shortly to double.

The firm of Morrison Brothers, manufacturers of plows at Fort Madison, Iowa, has been succeeded by the Morrison Manufacturing Company, a corporation organized under the laws of Iowa.

The Alabama Iron Company at Alabama Furnace has increased its capital stock to $300,000, which is all paid up, and will shortly begin the erection of another furnace of a daily capacity of 40 tons.

Seymour & Whitlock, of Newark, N. J., are doing a good business in their small engines, and power presses. A full force of workmen can scarcely produce the machines fast enough to keep up with the orders.

The South Tredegar Iron Works of Chattanooga, Tenn., have decided to introduce Swedish labor altogether in certain departments of their mill. Seven of these Swedes have arrived, and several more will arrive shortly.

The location of the newly formed wire goods company at Palmer, Mass., has been agreed upon, and a building 100x40 feet will be erected at once. The company has organized with a capital of $30,000.

Tulloss & Co., of the Hawkeye Machine Shops, Iowa City, have just completed an entire outfit of machinery for a saw-mill. This firm is busy working on small vertical engines for country work, which are in good demand.

Gardiner, Me., is to have a shoe factory, a company having been organized to proceed to business Moore & Brown have taken a contract to build the factory, 150x50 feet, 3 stories high, for $8,000, exclusive of piping. It is to be done by December 1st.

Cyrus Currier, of Newark, N. J., is working on the construction of one 100-horse power engine and two 50-horse power engines. There are also several paper-making machines partly finished. The demand is considered quiet for the machinery this shop generally works on.

It is said that Broad River, at Anthony Shoals, Georgia, has a volume of 19,000,000 cubic feet of water per minute, and its velocity is 175 feet per minute, its fall in a mile and a quarter being 92 feet. The horse-power is calculated to be 37,286, while Lowell has only 16,000 horse-power.

A new corporation has been organized in Troy, N. Y., called the Holland Lubricator and Brass Company, manufacturers of lubricators, oil cups and brass work. Capital $40,000. The trustees are Timothy Holland, David Cowee, Robert W. Hunt, Walter B. Bush, Jr., Sidney W. Giles, Henry A. Merritt and Edward Green.

Nicol, Burr & Co., engine builders at Peoria, Ill., are about to erect a new machine shop on the site of their present works. The shop will be a 1-story brick and cover an area of 50x180 feet under one iron truss roof. They are now building a pattern shop, wareroom and office, which will be of brick, 3 stories high, with an area of 33x86 feet.

The Newark (N. J.) Filtering Company which performs the process of water cleansing in a cylindrical vessel, are getting ready to commence construction of their filters on a large scale. By their process the material used for eliminating impurities from the water is constantly subjected to an action which throws out the foreign matter drawn from the water so that a small filter will purify a large quantity of water.

The new warehouse of the Knowles Steam Pump Works, 93 Liberty Street, New York, is 100 feet deep and 30 feet front. It is fitted up and furnished in the best style. On the main floor can be seen a line of Knowles pumps and boilers; also boilers and pumps combined. Samples of all their specialties, such as vacuum pumps, blowing engines, fire pumps, air pumps, and condensers, are kept on hand. Visitors are welcomed and treated in an agreeable manner whether they make purchases or not.

The Geo. F. Blake Mfg. Co.'s warehouse, 95 and 97 Liberty Street, New York, has been fitted up almost regardless of expense. It is 110 feet deep and 32 feet front. A new plate-glass front has been put in, and the whole place refitted and newly furnished. A line of Blake pumps are here shown, including duplex pumps, air compressors, artesian well pumps, sinking pumps, brewers' air pumps, and vacuum pumps. The new catalogue they have just issued contains cuts and descriptions of these; also a number of tables, very carefully compiled, which are very useful to engineers.

H. A. Streeter, of the Globe Iron Works, Chicago, is erecting at Nos. 31 to 41 Indiana street extensive factories for the production of patent wrought-iron sash, flexible harrows and general iron work These works are to be of brick, 65x75 feet in dimensions, 4 stories high, with a basement. The latter will be used for a blacksmith shop and for heavy machinery, the first story for offices and light machinery, the second story for the manufacture of the flexible harrows. These works are to be completed by the 1st of November and equipped with an engine of 60-horse power and an excellent outfit of machinery

The Newark Local Light and Power Company has an excellently arranged station in Newark, N. J. They are running 264 arc lights, 71 incandescent lights and 1 motor. Weston dynamos are used for producing the electricity. The power is furnished by a Watts, Campbell & Co. Corliss engine of 250-horse power. Steam is supplied by four return flue boilers made by Hewes & Phillips, and the power is produced by an expenditure of 2½ pounds of coal per indicated horse-power. A system of close inspection of all supplies is followed, and every pound of coal used is weighed. To this method of close control is probably due part of the economical results. Every machine and tool in the place is kept clean and neat as a watch, and J. F. Baker, the superintendent, deserves credit for the performance and appearance of the establishment.

The Chattanooga *Tradesman* says the New York Iron Roofing Co. have decided to erect a branch factory in this city, having found the advantages there far superior to elsewhere in the South. A stock company will be organized in a few days with a capital of $100,000. It is their intention to have the factory in operation by December 1.

Gould & Eberhardt, of Newark, N. J., by a special arrangement of construction are making most of their lathes capable of cutting threads up to 6" pitch. This is done to meet the growing demand for worm gearing. We recently witnessed some very fine tests to show the accuracy of several planers just finished. They laid a true surface straight edge four feet long in all positions on the planer table and made it rest on three or four strips of tissue paper. In no instance could the strip be pulled out. All the test-gauges in this establishment are very carefully preserved. The gear-cutting machine made by this firm is an excellent production, every movement, including the carrying away of the chips, being performed automatically. A convenient shop device is a surface plate 3½x2' with square edges which is set up like a table and is used for scribing and laying out work.

D. Saunders' Sons, Yonkers, N. Y., are finding sufficient sales for their well known pipe-cutting machines and machinery to take the present output of the shop and reduce their stock materially. They have sold quite a number of machines in different European countries, a recent order being for a large machine from Germany. They have nearly completed a 20" swing engine lathe for use in their tool-room. This lathe is a finely built tool, and possesses several novel features. The journals are hardened and run in hardened boxes. By the simple movement of a lever the boxes are slightly loosened on the journals, and by a reverse movement are tightened exactly as they were before being loosened. This, it is believed, will be especially advantageous in a tool-makers' lathe, where for obvious reasons it may be desirable to speed up the lathe quickly for a few moments at a time. The jaws for the boxes are tied together at the top over the cone, making the bearings rigid. The tail-spindle is hardened on the end and as far back as the center way extends. This firm make extensive use of the milling machine in their work, and speak highly of its advantages.

Otis Bros. & Co., Yonkers, N. Y., are unusually busy on all classes of elevator work. This company's shops have grown from a single small building (which when erected was believed ample for probable future use) to cover several times the ground originally covered, and are still too small for their purpose. C. W. Baldwin is engaged at their works in perfecting a gas engine, which differs in several particulars from any heretofore constructed. No gas reservoir is used, and an explosion takes place at each stroke, the governor operating to regulate the intensity of the explosion to correspond with the changes of load, but not to prevent an explosion. It is proposed to use this engine for operating elevators and for manufacturing purposes. It is also believed that the regulation will be sufficiently close to admit of its use for electric lighting purposes. The cylinder of the engine is lubricated by means of a novel lubricator which seems to accomplish its purpose admirably. In this lubricator what may be called a small rotary piston measures out at each of its revolutions a certain quantity of oil and delivers it to the cylinder. The especially novel feature is the means by which this piston is rotated, which is by the differing pressure in the engine cylinder. This pressure, changing during each stroke, reciprocates a small piston through a short distance, the motion of which turns the rotary piston by the aid of a pawl and ratchet, the arrangement being such that the pawl will move a distance of one or any number of teeth, by which the time in which the rotary piston revolves, (and hence the feed) is regulated. The experimental engine is of very neat design, and seems to run equally well at slow or quick speed.

The Buckeye Engine Company, Salem, O., writes us:

"The engine you refer to in issue of August 25 as sent to Hartman Steel Company should be 26½x36" cylinder. We are making for the same company one 24x36" and one 26x36" engines; have shipped very recently to

Xenia Twine Co., Xenia, O.	13x26"
Wohler Tin Co. of Chicago	14x28"
H. Julius Kleugh, Butler, Pa	13x26"
Marshall Field & Co., Chicago, for electric lighting	14x28"
H. M. Myers Shovel Works, Beaver Falls, Pa	16½x24"
Iowa Barb Wire Co., Easton, Pa	12x24"
Dayton (Ohio) Malleable Iron Co.	11x22"
James, Peters & Co, Latrobe, Pa	16x32"
Friend & Fox Paper Co., Lockland, O.	12x24"
Orr, Leonard & Daniels, Piqua, O.	14x28"
Piqua S. B. & Paper Co., Piqua, O.	16x32"
Henry Disston & Sons, Chicago	14x16"
Birmingham (Ala.) Cotton Mills	20x40"
New York, Chicago & St Louis Railway Co. Chicago shops	16x32 '
A. B. Chase Organ Co., Norwalk, O.	14x28"
McKeen Bros., Terre Haute, Ind.	24x48"
Dayton (Ohio) Electric Light Co.	18x36"
Southern Exposition, Louisville, Ky.	15x30'
Robinson & Casey, St. Paul, Minn.	16x32"
Des Moines (Iowa) Electric Light Co.	16x36"
Harvey Bros., Willsburg, W. Va.	15x30"
Winona (Minn.) Harvester Works	18x36"
J. R. Gent & Co., Columbus, Ind.	13x25"

and quite a large number of orders not executed yet. Running full number of men full time, and very busy, and engines giving best of satisfaction."

Machinists' Supplies and Iron.

NEW YORK, August 23, 1883.

There is nothing noteworthy in the general supply trade.

In American iron transactions are quiet, but prices are held firm at $22.50 to $23.50 for choice brands of No. 1 X foundry. Inferior brands are sold at $21.50. No. 2 X foundry is dull with prices quoted at $19.50 to $20.50. Scotch pig is slightly weaker, but prices are nominally without material change. We quote: Coltness, $23.75 to $24; Glengarnock, $23; Gartsherrie, $23.50; Summerlee, $23 to $23.50, and Eglinton, $21 to $21.50.

Copper, 15c. to 15¼c. for lake and 14c. to 14½c. for other brands, with buyers providing only for immediate consumption.

Antimony—Hallett's 9¼c.; Cookson's, 10¼c., with sales at slightly lower prices.

Lead, 4¼c., with little demand.

Tin is held firm at 21¼c. for Straits and Malacca and 22¼c. for Banca.

In Spelter we quote: Common Domestic at 4.35c. to 4.60c.; Refined, 8c. to 8¼c.; Silesian, 5c. to 5¼c.

Boiler Plate sells as follows: Tank, 2¼c. to 2¾c.; Refined, 2¾c. to 3c.; Shell, 3¼c. to 3½c.; C. H. No. 1 Flange, 4¼c. to 4½c.; extra Flange and Fire Box, 5¼c. to 5½c.; Siemens Steel Plate, 5½c. to 6c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue

Mechanical draughtsman, good reference, wants engagement. 239 Broadway, Room 34, N. Y. City.

Wanted—Situation as fireman or assistant engineer; 2 years' practice. Address William Muskett, Wardsville, Canada.

Wanted—A novelty in the machinists' small tool line to sell on commission, by a young man now handling standard tools; best of reference given. Address Business, Box 91, Athol, Mass.

Wanted—A situation as foreman. A practical man will soon be at liberty to take a position as foreman of machine shop. Good references given. Address, Foreman, care of AMERICAN MACHINIST.

Wanted—A superintendent for an agricultural implement factory manufacturing mowers, reapers, horse rakes and plows, and employing about 200 hands. We want a man of practical experience, good executive ability and thoroughly competent to take charge of such an establishment. Address giving references and salary expected, Frost & Wood, Smiths Falls, Ontario, Canada.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd. O. Chase, Newark, N. J.

Wanted—A partner, a practical machinist, with about $1,800 capital. Address, Lock Box 97, Laconia, N. H.

Manufacturing property for sale, 30,000 feet floor space, competing point for four trunk lines railroads, switch from door. Write for terms and description B. W. Payne & Sons, Corning, N. Y.

Fine experimental machinery, models, patterns, novelties, &c., built from drawings or model. Specialty; cheap production of articles in quantity. Address or call upon T. L. Calkins, contract manufacturer, 291 West 11th street, corner Bleecker street, New York City.

Wanted—A hydraulic press of 100 tons capacity to take in work from two feet to five and one-half feet long and ten inches diameter, complete, with gauge pump and power attached. A second-hand press in good order would answer. State price, condition and send cut. Address, G. K., care of AMERICAN MACHINIST.

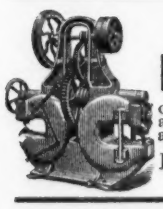
AUTOMATIC cut-off ENGINES.

Embodying a New System of Regulation.

THE GOVERNOR WEIGHS THE LOAD.

The most perfect Governing ever obtained.
Send for circular A.

BALL ENGINE CO., Erie, Pa.



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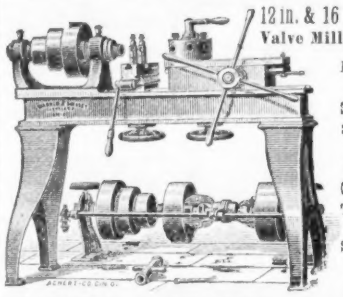
of beautiful design, of great strength and capacity, and thoroughly reliable, address
Lambertville Iron Works,
LAMBERTVILLE, N. J.

JOSIAH MACY'S SONS,
189 & 191 Front Street, New York,
MANUFACTURERS OF
Machinery, Engine, Cylinder, and Tempering
OILS
Samples Submitted Free. Established 1822.

BRASS WORKING MACHINERY.



12 in. & 16 in. Monitors
Valve Milling Mach's
Double Key Lathes,
Speed Lathes
Slide Rests
Revolving Chucks for Globe Valves,
Two-Jaw Chucks,
Small Tools and Fixtures.

WARNER & SWASEY, Cleveland, O.

WILDE'S PATENT
Expanding Mandrel
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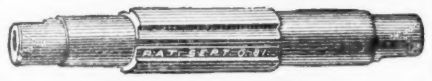

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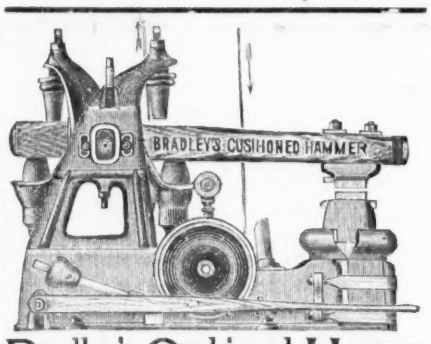

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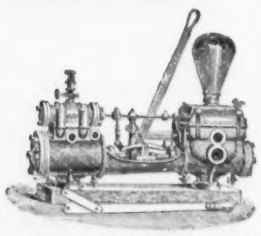

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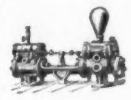

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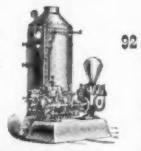

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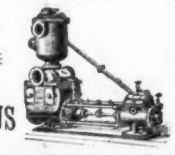

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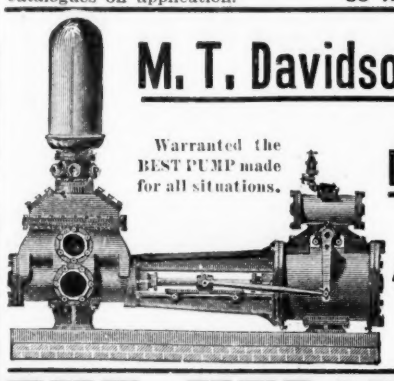

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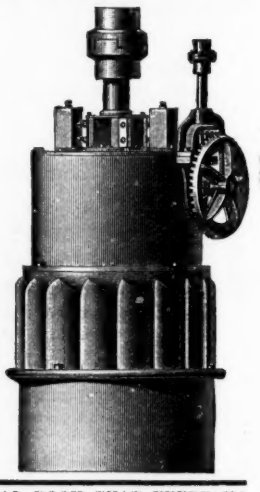

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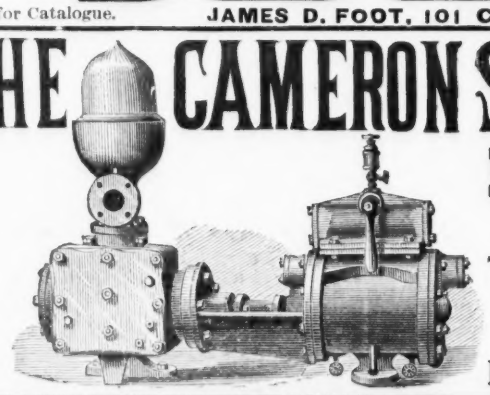

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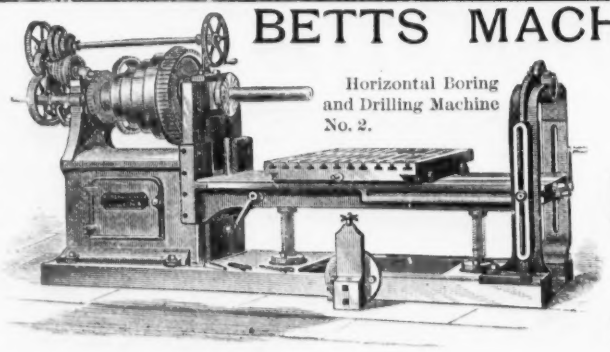

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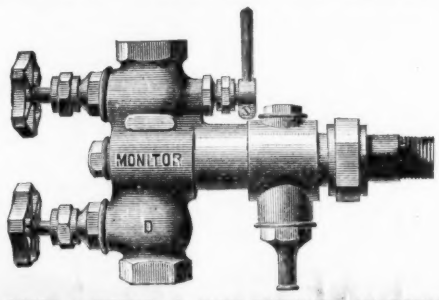

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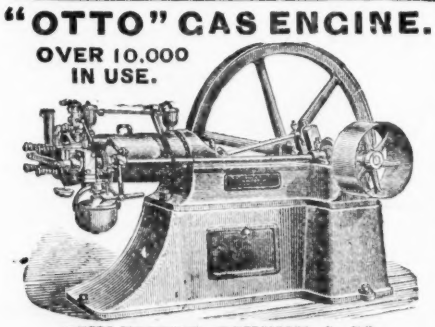

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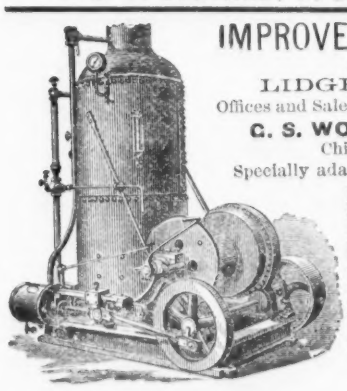

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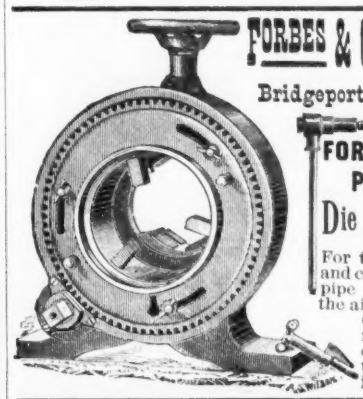

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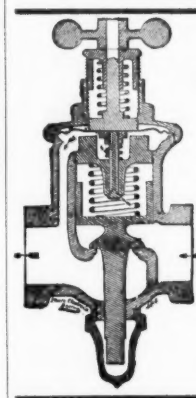

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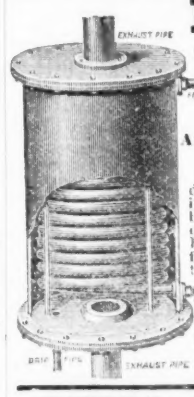

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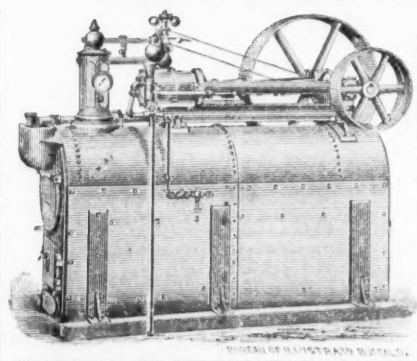

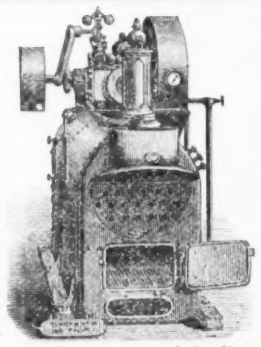

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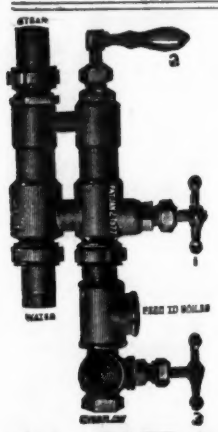

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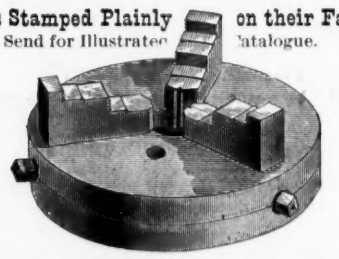

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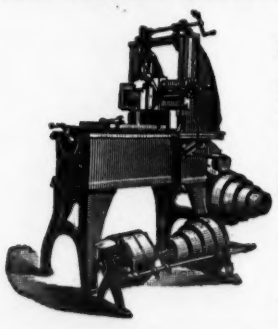

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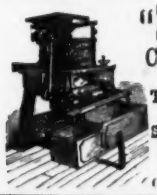

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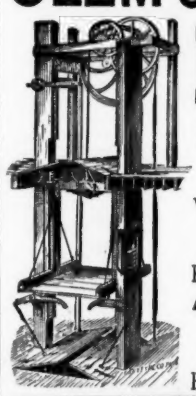

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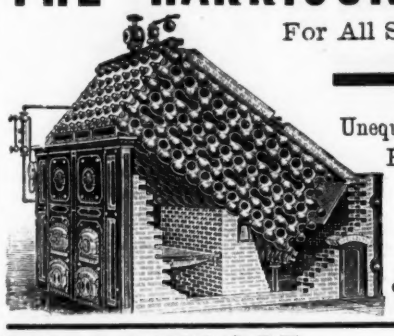

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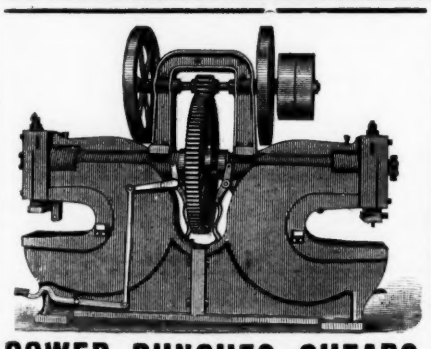

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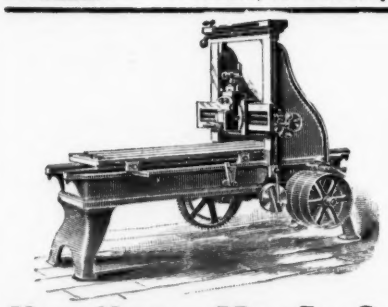

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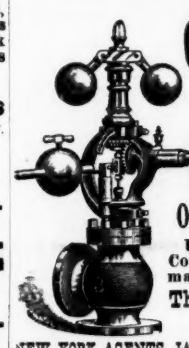

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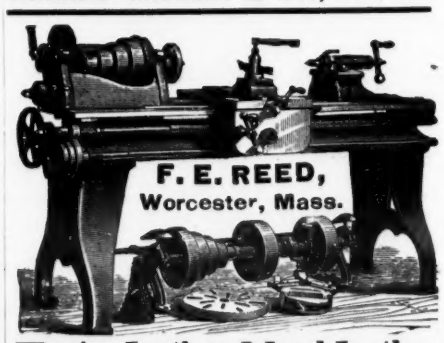

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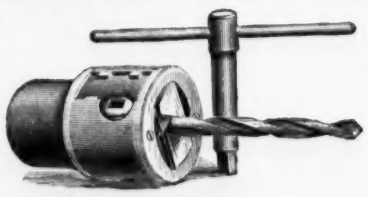

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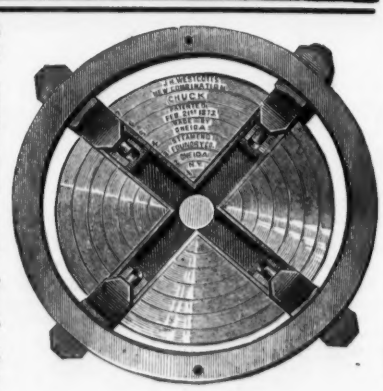

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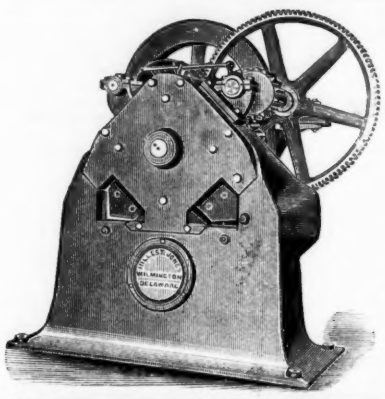

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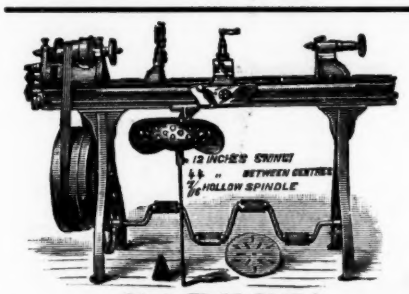

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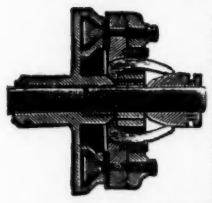

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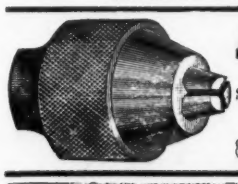

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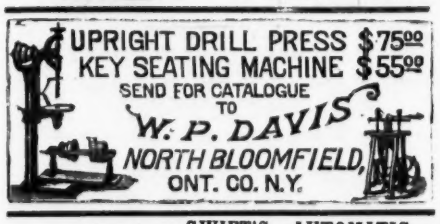

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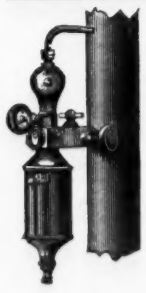

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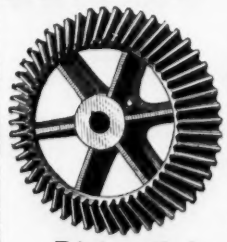

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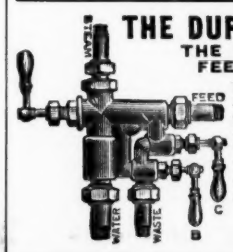

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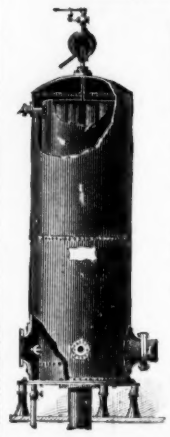

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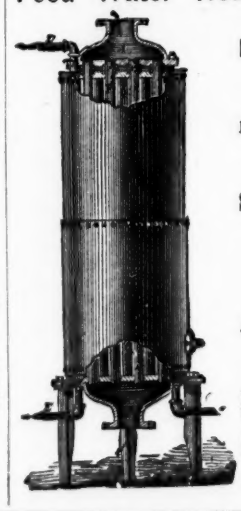

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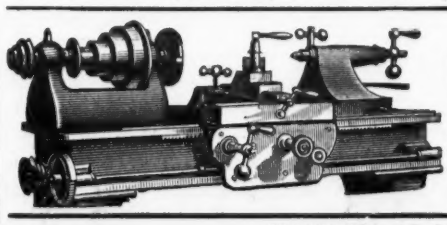

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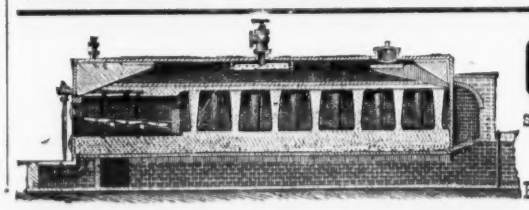

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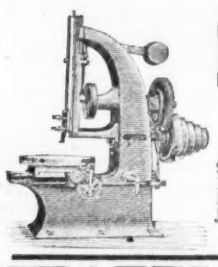

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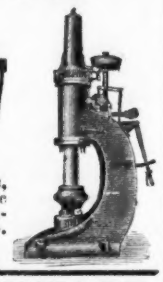

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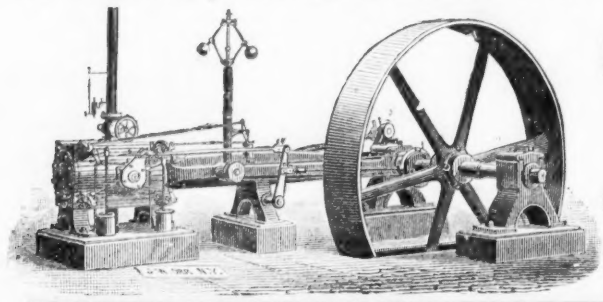

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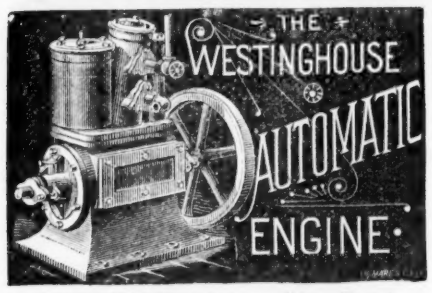

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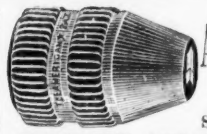

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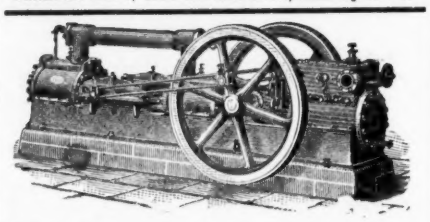

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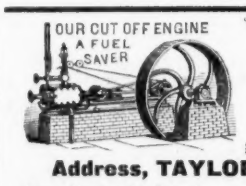

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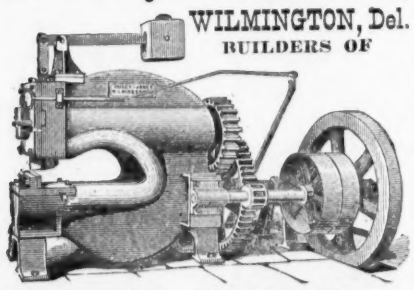

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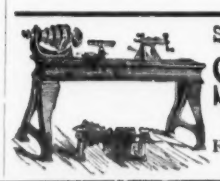

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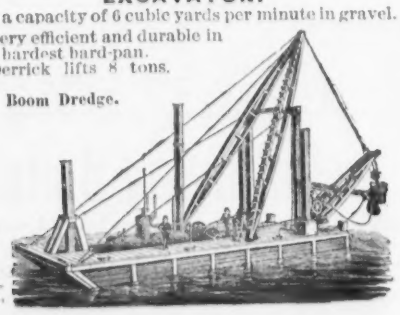

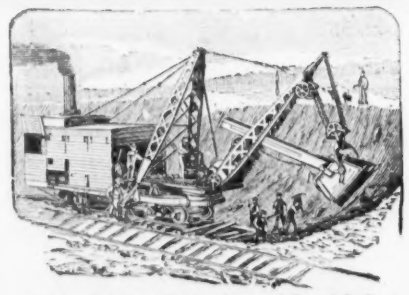

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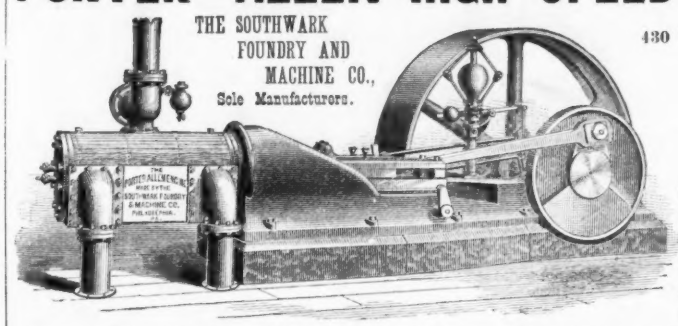

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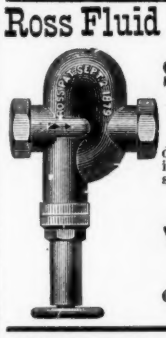

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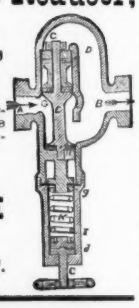

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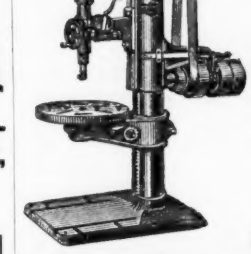

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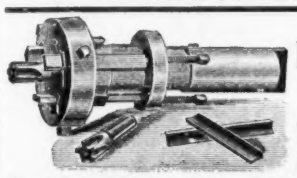

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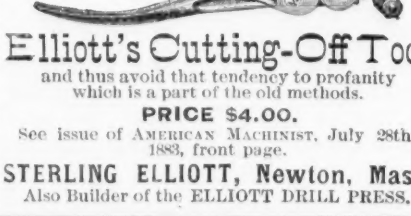

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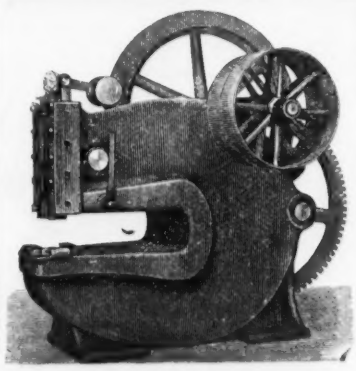

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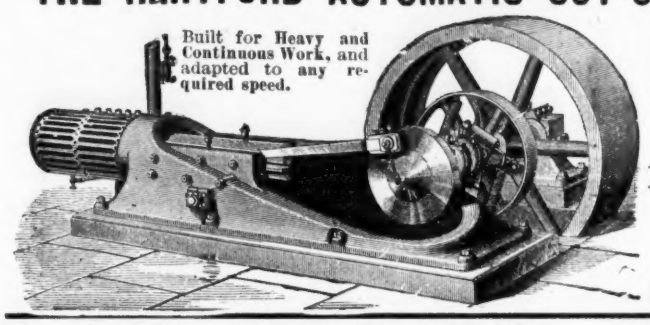

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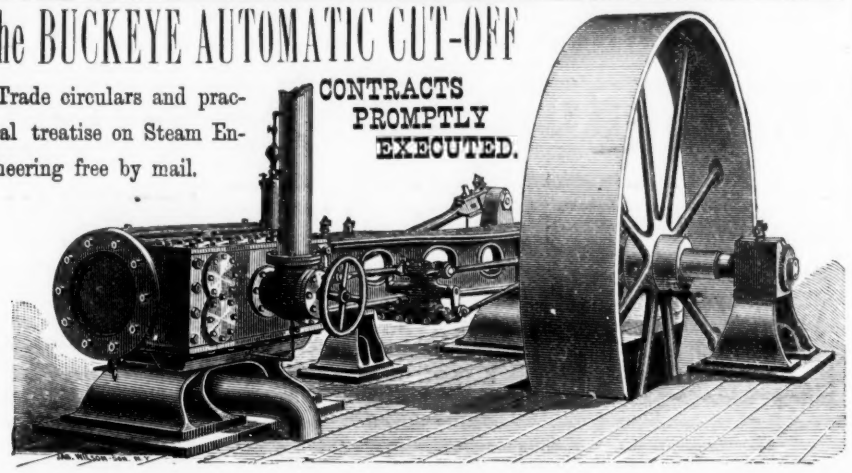

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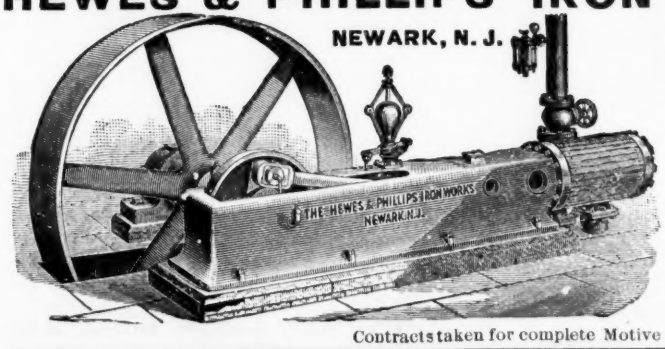

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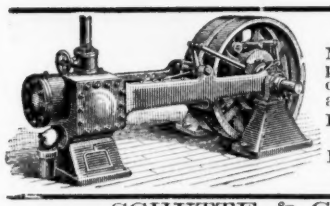

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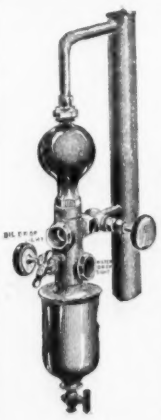

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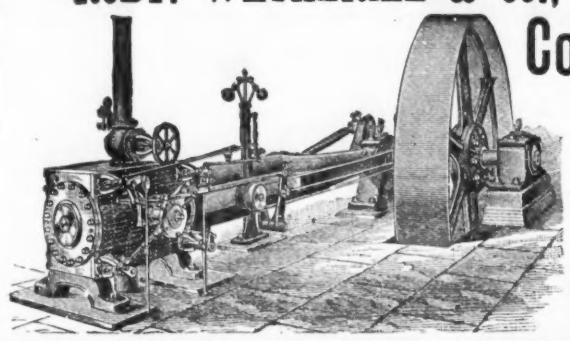

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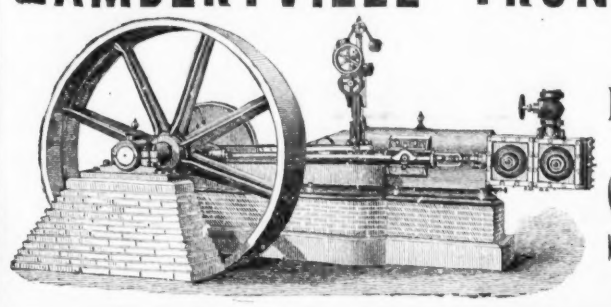

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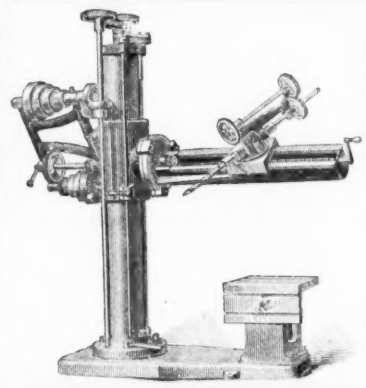

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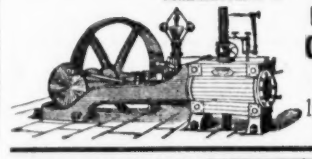

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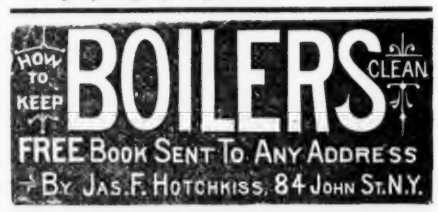

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One Engine Lathe, 20 feet bed,	42 in.	swing.
One "	18 "	36 "
One "	each 14, 16 and 18 feet bed,	30 in. swing.
One Engine Lathe, each 10 and 12 feet bed,	27 in. swing.	
One Engine Lathe, each 8, 10 and 12 feet bed,	23 in. swing.	
One Engine Lathe, each 8, 10 and 12 feet bed,	19 in swing.	
One Engine Lathe, 8 feet bed,	18 in. swing.	
One "	each 6 and 8 feet bed,	16 in. swing.
One Engine Lathe, 6 feet bed,	15 in. swing.	
One "	5 "	11 "
Two Iron Planers, to plane	10 feet, 30 x 30 in.	
Two "	to plane 7 feet, 26 x 26 in.	
Two "	to plane 4 feet, 22 x 22 in	
One each 22, 24, 26, 30 and 38 in. swing B. G. S. F. Upright Iron Drills.		
One Shaper, each 10 and 15 in. stroke.		
Two Shapers, each 12 in. stroke.		
Two Bolt Cutters, to cut 1½ and 2 in		

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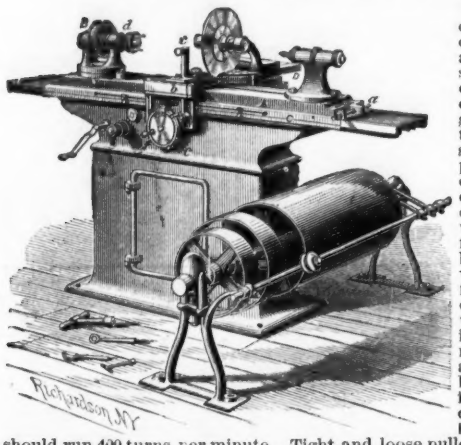
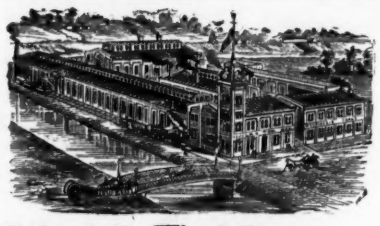


This Machine is arranged for doing a large variety of operations of grinding by the use of solid emery or corundum wheels. An additional movable table, capable of adjustment by a tangent screw and graduated arc, admits of straight and curved taper grinding with the centers of the machine always in line. It is specially adapted for grinding soft or hardened spindles, arbors, cutters, either straight or angular, reamers and standards, also for grinding out straight and taper holes, standard rings, hardened boxes, jewelers' rolls, &c. The work can be revolved upon dead centers or otherwise. The grinding wheel can be moved over the work at any angle, by which means any taper can be produced. Wheels from one quarter inch to 12 inches in diameter can be used either with or without water. The feed works and slides of the machine are covered and fully protected from grit and dust. The grinding of taper holes and angular cutters is provided for with graduated arcs. A special chuck for holding work to have holes ground, accompanies each machine. The spindle and boxes of the machine are of cast steel hardened and ground. Distance between centers, 28 inches; will swing 12 inches in diameter. The overhead works consist of a drum, tight and loose pulleys and adjustable hangers with self-oiling boxes. Countershaft should run 400 turns per minute. Tight and loose pulleys, 8 inches diameter, 4 inches face. Weight of machine, with overhead works, about 2300 lbs. Illustrated Catalogue sent per mail on application.



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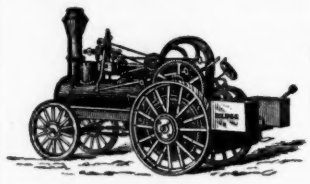

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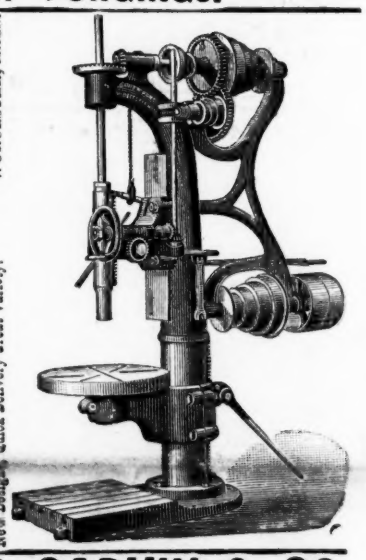

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